Original Research Article

"TREATMENT OUTCOME OF PULMONARY AND EXTRA PULMONARY TUBERCULOSIS PATIENTS REGISTERED AT DOTS CENTRE IN A TERTIARY CARE HOSPITAL, MYSURU, KARNATAKA, INDIA."

Abstract:

Context: Extrapulmonary tuberculosis (EPTB) constitutes 15–20% of tuberculosis cases in India. Earlier studies have evaluated treatment outcomes of TB with little information on comparison of outcomes of Pulmonary and EPTB.

Aim: To compare the personal variables, clinical characteristics and treatment outcome of Pulmonary and Extra Pulmonary Tuberculosis (EPTB) patients.

Settings and Design: A Prospective observational study was conducted in DOTS centre of teaching hospital, Mysuru, Karnataka from December 2019 to December 2020.

Methods and Material: All newly diagnosed patients were registered and followed up during their course of treatment to assess treatment outcome. Data is collected by using personal variable proforma and clinical characteristic form.

Results: Among 197 TB patients' 120(60.91%) suffering with EPTB and remaining 77(39.08%) have PTB. Majority 101(51.26%) patients were diagnosed by microbiological confirmation and remaining 96(48.73%) were clinically diagnosed. Even though majority 140 (71.06%) completed the treatment only 10(5.07%) were cured. Among 16(8.12%) TB patients have treatment failure and were lost to follow up. Treatment success rate is (0.5%). Confirming the presence of TB by microbiologically and clinically is having influence in diagnosis of EPTB, as well as consumption of alcohol is having influence in developing EPTB. Residence of the patient is a risk factor for the treatment outcome.

Conclusion: TB treatment outcome can be enhanced by improved supervision, improved counselling activities and implementation of default tracing and home visit by health worker.

Key words: Tuberculosis, Pulmonary, Extrapulmonary, Outcome

Introduction

More than a quarter of all Tuberculosis (TB) cases are found in India. This equates to around 2.6 million cases out of a total of 10 million worldwide. Nearly 0.44 million individuals have died in India as a result of this disease[1]. According to the World Health Organization (WHO), India has one-third of the world's drug-resistant tuberculosis cases [2].

The causative organism Mycobacterium tuberculosis, which is predominantly airborne, affects the lung causing pulmonary TB. When TB is bacteriologically confirmed or clinicily diagnosed in other parts of the body other than the lung such as the abdomen, meninges, genitourinary tract, joints, bones, lymph nodes and skin it is classified as extrapulmonary tuberculosis (EPTB)[3].The prevalence of EPTB among new and relapse TB cases globally in 2016 was 15% .The lowest prevalence (8%) was recorded in the WHO Western Pacific Region while the highest (24%) was recorded in the Eastern Mediterranean. The figure for the African Region was 16%[4].

EPTB has been bacteriologically verified or clinically diagnosed in areas other than the lungs, such as the GI system, meninges, genitourinary tract, joints, bones, lymph nodes, and skin.[5]

EPTB was found in 15% of new and relapsed TB patients worldwide in 2016. EPTB accounts for 15–20 percent of tuberculosis cases in India.[6]

It is critical to compare personal variables, clinical characteristics, and treatment outcomes between PTB and EPTB in order to prevent and manage it.[7]

As a result, this study is to look into the treatment outcomes of PTB and EPTB patients who have been registered at a DOTs centre in a tertiary care hospital in Mysuru.

Method and Methodology

Retrospective case series analyses of TB patients were studied in Tertiary care teaching hospital, Mysuru, Karnataka, India between December 2019 to December 2020. The aim of this study was to compare the personal variables, clinical characteristics and treatment outcome of Pulmonary and EPTB. Study included 197 patients who were diagnosed with TB. Data was scrutinized based on personal variables and the clinical characteristics of TB. Only lung parenchyma involvement was considered as Pulmonary TB (PTB). Extra Pulmonary TB (EPTB) was defined as the involvement of organs other than the lung parenchyma, such as the lymph nodes, pleura, abdomen, genitourinary tract, gastrointestinal tract, skin, joints and bones, meninges, and others.

Study was approved by the Ethical Committee of the (ref. JSS/MC/IEC0/605/2018-19, dated:10.05.19).Differences in personal variables and clinical characteristics of EPTB and PTB were compared and analysed using the Z test. Odds ratios (ORs) and confidence intervals (CIs) were calculated to identify factors associated with EPTB compared to PTB related to treatment outcome.

Result and Discussion

Data collected is analysed and presented in the following headings.

1. Frequency and percentage distribution of Tuberculosis patients according to their personal variables and clinical characteristics

In the present study out of 197 TB patient's majority 120 (60.46%) were males, 25(22.84%) of them were in the age group of 30 to 40 years, 174 (81.84%) were married and 141(71.56%) of them were living in nuclear family. Study also shows that 168(85.27%) of TB patients are from urban area and 186 (94.44%) were belong to Hindu religion. 47(23.85%) have Intermediate/ diploma as their education status, 84(42.63%) of them were farmers and 136(69.03%) were from upper lower socioeconomic class

The present study shows that out of 197 TB patients 100 (50.76%) have family history of TB and 120(60.91%) suffering with EPTB and remaining 77(39.08%) have PTB. Majority 101(51.26%) patients were defined by microbiological confirmation and remaining 96(48.73%) were clinically diagnosed. Sputum ZN is the method of diagnosis in 156(79.18%) and remaining 41(20.81%) diagnosis is confirmed by CBNAAT. 181(91.87%) were newly diagnosed TB patients,12(6.09%) were transferred in cases and 4(2.03%) were recurrent cases. (and 16 (30.96%) were previously treated.

Study also reveals that majority were 161(81.72%) not suffering from Diabetes Mellitus and all (100%) have nonreactive HIV status. Only 38(19.28%) of TB patients were smokers and 35(17.76%) were known alcoholics and majority 140 (71.06%) completed the treatment where only 10(5.07%) were cured. Among 16(8.12%) TB patients have treatment failure and were lost to follow up. Treatment success rate is (0.5%)

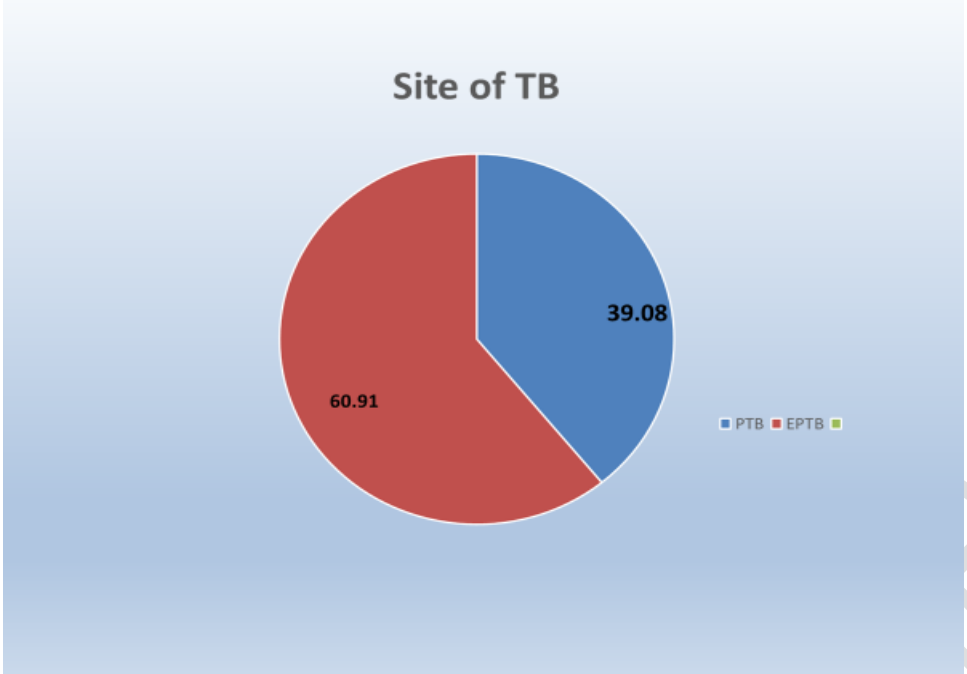

Fig.1: Distribution based on site of TB

Table1: Distribution based on type of EPTB cases

n=120

Involved area	**Frequency**	**%**
Lymph nodes	**31**	**25.83**
Cervical	23	19.16
Submandibular	3	2.5
Supraclavicular	3	2.5
Axilla	1	0.83
Femoral	1	0.83
Nervous system	**4**	**3.33**
Potts spine	1	0.83
Meninges	3	2.5
Vocal cord TB	**1**	**0.83**
Ocular	**7**	**5.83**

Pleural	**64**	**53.33**
Abdominal	**7**	**5.83**
Intestine	6	5
Peritoneum	1	0.83
Urogenital	**2**	**1.66**
Renal TB	1	0.83
Epididymitis	1	0.83
Skin TB	**1**	**0.83**
Miliary TB	**3**	**2.5**

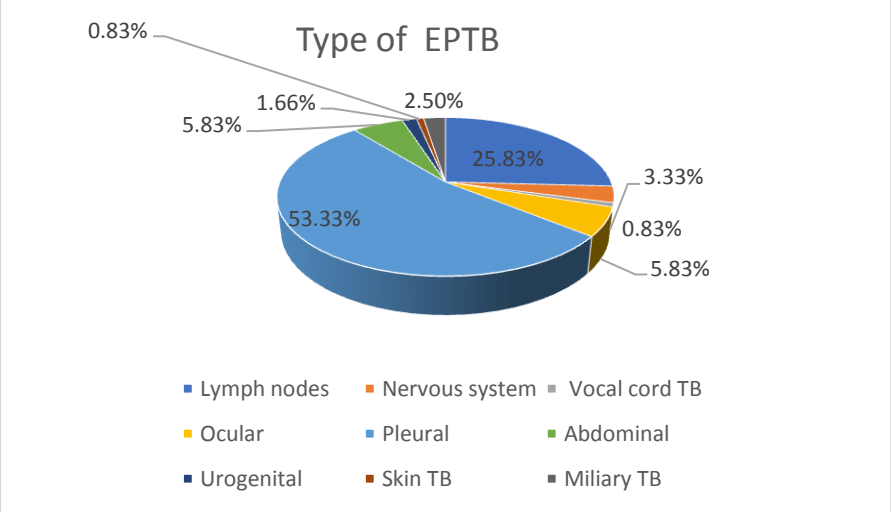

Fig.2: Distribution based on type of EPTB cases

Data shows that out of 120 EPTB patients pleural effusion (46.66%) is the most frequent type of EPTB. 25.83% of them were having lymphadenopathy of cervical, supraclavicular, submandibular, axillary and femoral. In lymph node involvement majority 23(19.16%) had cervical lymph node involvement.

2. Comparison between PTB and EPTB patients with their selected personal variables and clinical characteristics

Table:2 Comparison between PTB and EPTB with their selected personal variables and clinical characteristics. n=77+120=197

Personal variables and clinical characteristics		**PTB**	**EPTB**	**Z value**	**P value**
Gender	Male	51(66.23%)	69(57.5%)	1.3079	0.1902
	Female	26(33.76%)	51(24.28%)	1.5583	0.1187
Age in years	20-30	17(22.07%)	25(20.83%)	0.1721	0.865
	31-40	15(12.5%)	30(25%)	-2.3674	0.0177
	41-50	10(12.98%)	16(13.33%)	0	1
	51-60	18(23.37%)	25(20.83%)	0.3414	0.7278
	61-70	11(44.28%)	20(16.66%)	4.1467	<0.0001
	71-80	4(5.19%)	4(1.90%)	0	1
	81-90	2(2.59%)	0	1.7452	0.0801
Marital status	Married	68(88.31%)	106(88.33%	0	1
	Unmarried	9(11.68%)	14(11.66%)	0	1
Type of family	Nuclear	55(71.42%)	86(71.66%)	-0.1566	0.8728
	Joint	22(28.57%)	34(28.33%)	0.1566	0.8728
Residence	Urban	67(87.01%)	101(84.16%	0.6025	0.5485

	Sub urban	7(9.09%)	11(9.16%)	0	1
	Rural	3(3.89%)	8(10.38%)	-1.6628	0.0969
Religion	Hindu	74(96.10%)	112(93.33%	0.9305	0.3523
	Muslim	2(2.59%)	7(5.83%)	-1.0233	0.3077
	Christian	1(1.29%)	1(0.83%)	0	1
Education	Illiterate	5(6.49%)	10(8.33%)	-0.5543	0.5823
	Primary/middle school	19(24.67%)	30(25%)	0	1
	High School	19(24.67%)	18(15%)	1.7678	0.0767
	Intermediate/ diploma	18(23.37%)	24(20%)	0.5164	0.603
	Graduation/Profession	16(7.79%)	38(31.66%)	-4.2426	<0.0001
Occupation	Home maker /Unemployed	2(2.59%)	6(7.79%)	-1.5508	0.1211
	Student	2(2.59%)	2(1.66%)	0.4529	0.6527
	Coolie worker	5(6.49%)	3(2.5%)	1.7055	0.0872
	Farmer	35(45.45%)	49(40.83%)	0.0571	0.5686
	Clerical worker	12(15.58%)	18(15%)	0.1954	0.8414
	Professional/ Technical	21(27.27%)	42(35%)	-1.2231	0.2224

	Upper middle	0	1(0.83%)	-1.0025	0.3173
	Lower middle	14(18.18%)	23(19.16%)	-0.1821	0.8571
	Upper Lower	56(72.72%)	80(66.66%)	0.9258	0.3523
	Lower	7(9.09%)	16(13.33%)	-0.904	0.3681
Family history of TB	Yes	37(48.05%)	63(52.5%)	-0.5657	0.5686
	No	40(51.94%)	57(47.5%)	0.7071	0.4777
Case Definition	Microbiologically confirmed	49(63.63%)	52(43.33%)	2.9772	0.0028
	Clinically diagnosed	28(14.21%)	68(56.66%)	-6.3542	<0.0001
Type of patient	New	72(93.50%)	109(90.83%	0.5213	0.603
	Transferred in	4(5.19%)	8(6.66%)	-0.5955	0.5485
	Recurrent	1(1.29%)	3(2.5%)	-0.5817	0.5619
Method of diagnosis	ZN	64(83.11%)	92(76.66%)	1.0607	0.2891
	CBNAAT	13(16.88%)	28(23.33%)	-1.0607	0.2891
Treatment regimen	New	70(90.90%)	111(92.5%)	0.2536	0.8025
	Previously treated	7(9.09%)	9(7.5%)	0.5213	0.603
Known case of	Yes	11(14.28%)	25(12.69%)	0.2069	0.8336

Diabetes	No	66(85.71%)	95(48.22%)	5.7144	<0.0001
Smoking	Yes	16(20.77%)	22(18.33%)	0.5354	0.5892
	No	61(79.22%)	98(81.66%)	-0.5354	0.5892
Alcoholism	Yes	19(24.67%)	16(13.33%)	2.163	0.0307
	No	58(75.32%)	104(86.66%	-2.163	0.0307
Outcome	Treatment completed	56(72.72%)	84(70%)	0.4699	0.6383
	Cured	6(7.79%)	4(3.33%)	1.5508	0.1211
	Treatment failed	4(5.19%)	12(10%)	-1.3423	0.1802
	Died	8(10.38%)	6(5%)	1.3423	0.1802
	Lost to follow up	3(3.89%)	13(10.83%)	-1.8792	0.0601
	Treatment success	62(80.59%)	88(73.33%)	1.3442	0.1802

Data shows that 15(12.5%) in PTB and 30(25%) in EPTB were in the age group of 31-40 years and the calculated Z value is -2.3674 and p value is 0.0177, inferring that in EPTB patients age was not an influencing factor for developing EPTB than PTB patients.

In PTB 16(7.79%) and in EPTB 38(31.66%) patients were having Graduation/Profession as their educational qualification. The calculated z value is -4.2426 and p value is <0.0001, hence, there is significant association between graduation/professional education with PTB and EPTB patients.

The calculated Z value for microbiologically confirmed cases is 2.9772 which is statistically significant where p value is 0.0028. Inferring that case definition will influence the PTB and EPTB patients.

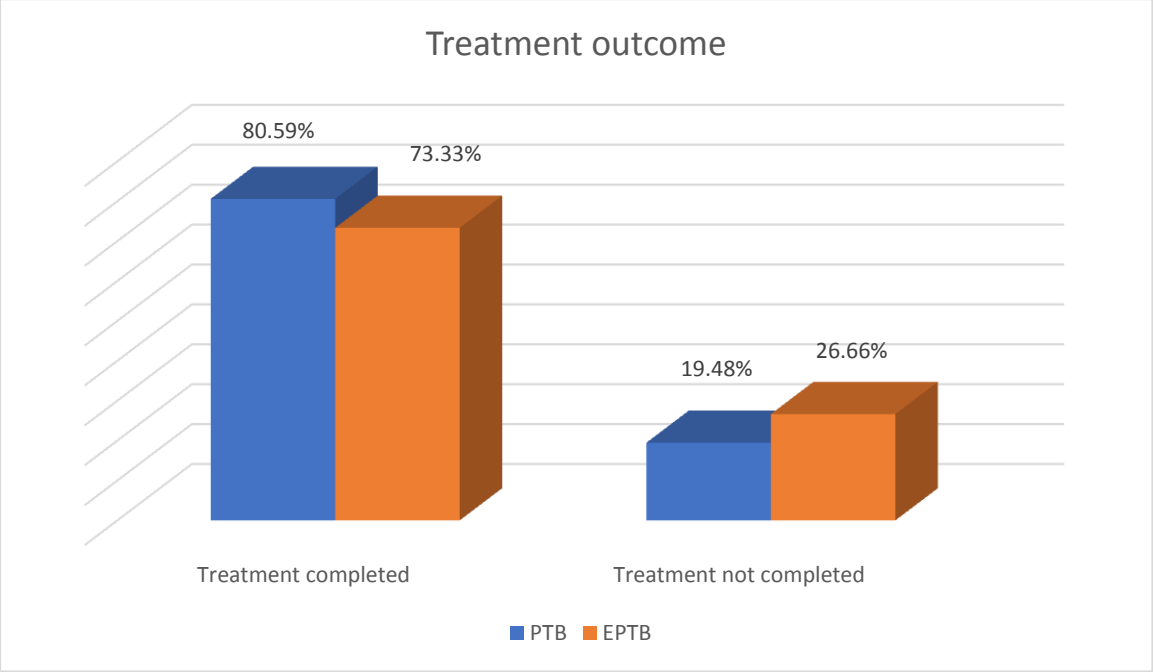

Figure 3: distribution treatment outcome among PTB and EPTB

Out of 77 PTB patients 62(80.59%) of them has completed the TB treatment and remaining 15(19.48%) has not completed the TB treatment. Out of 120 EPTB patients 88(73.33%) has completed the TB treatment and remaining 32(26.66%) has not completed the treatment.

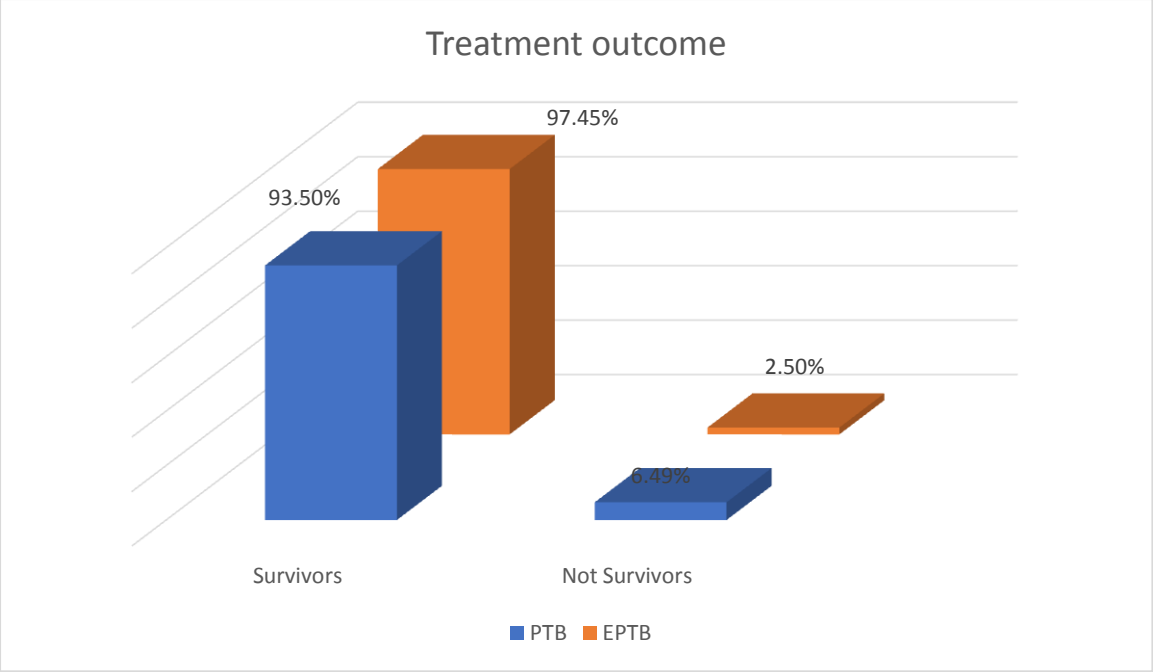

Figure 4: Distribution of treatment outcome among PTB and EPTB

It is evident in the figure that out of 77 PTB patients 72(93.50%) were survivors and remaining 8(4.06%) of them died due to PTB. Among 120 EPTB patients 117(97.45%) were survivors and remaining 3(2.05%) of them died due to complication of EPTB.

Comparison of treatment outcome of TB patients and their selected personal variables and clinical characteristics

To determine the association between the treatment outcome of TB patients and their selected personal variables and clinical characteristics odd ratio was calculated.

Table:3 Association between the treatment outcome of TB patients and their selected personal variables and clinical characteristics n=197

Sl.No	Personal variables and clinical Characteristics	Odds ratio	Confidence Interval
1	Gender	0.75	(0.33, 1.69)
2	Marital status	0.5	(0.11, 2.24)
3	Place of residence	2.53	(1, 6.4)
4	Type of family	0.9	(0.38, 2.16)
5	Religion	1.36	(0.42, 4.36)
6	Socio economic status	1.23	(0.44, 3.46)
7	Family history of TB	1.04	(0.48, 2.26)
8	Site of TB	0.81	(037, 1.78)
9	Type of case	1.06	(0.49, 2.31)

11	Known case of Diabetes	0.69	(0.27, 1.76)
12	Smoking	2.39	(0.68, 8.33)
13	Alcohol	0.38	(0.05, 2.98)
14	Method of diagnosis	0.73	(0.26, 2.04)

It is evident from the study that residence of the patient is influencing factor for the treatment outcome as the odd ratio is <1 (2.53) with confidence interval <1 (1, 6.4). Hence patients residing in urban area have 2% more treatment completion rate than the patients residing in rural area. Other selected personal variables and clinical characteristics where not influencing the treatment outcome.

Discussion

Total number of patients recruited was 197 among them 156(73.6%) were males, 128(60.38%) of the patients had rural residence and 84(39.62%) were from urban setting. Majority 120(60.91%) of TB patients were by EPTB and remaining 77(39.08%) were diagnosed as PTB. Similar findings were found in a study which revealed that globally ,the notification rates decreased over time, rates in males became higher than those of females for all ages over 15. Present notification rates of both sexes combined in many developing countries are similar to those of industrialized countries in the middle of the century, although the sex and age pattern is similar to that in industrialized countries at present, with men's disease rates exceeding women's after the age of 15.[7] Gender differences observed in our

study confirm the findings of previous studies in both developing [9,10] and developed countries [11,12] .This may be a consequence of gender differences in both exposures to TB infection and prevalence of susceptibility risk factors (e.g., smoking) [9].

The majority of PTB patients 40(51.94%) did not have family history of TB and EPTB majority of patients 63(52.5%) were having family history of TB. The other main risk factor for EPTB relative to PTB that we identified was being younger than 25 years. This is consistent with studies from the USA [13]and Europe [14] which have reported that younger age was an independent risk factor for EPTB. Other studies from the USA[15] and Turkey[16], have reported that age was not associated with EPTB. These inconsistencies could be due to differences in prevalence of host-related factors or important co-exposures.

In our study, only 16(20.77%) in PTB and 22(18.33%) in EPTB were smokers. This raises the possibility that the age and sex differences between PTB cases and EPTB cases could be a result of confounding by smoking. However, after adjusting for potential confounding factors (including smoking) by logistic regression analysis, younger age and female gender remained strongly associated with EPTB. Therefore, after primary infection in the lungs the probability of reactivation at an extra-pulmonary site may be higher at younger age. It would be useful to confirm the association of age and gender with EPTB in other high-burden countries. [8]

In our study, smoking was not associated with treatment outcome. Contradictory to this finding another study which reported that smoking is a risk factor for TB infection and for pulmonary TB disease[17]. Another report has suggested that smoking is associated with relapse of TB and smokers are less likely to have isolated extrapulmonary TB [18]. We also found that past history of TB was associated with PTB, although we could not identify if this was as a result of reactivation (relapse) or reinfection [19]. However, evidence suggests that in high-burden countries reinfection is more common than relapse [20].

Our results are consistent with other studies that have reported an association between diabetes mellitus and treatment outcome[22,23]. However, study from Turkey[16] examined the association of diabetes, use of immunosuppressive drugs/steroids and past history of TB with EPTB but found no association with any of these factors. A study from the UK [23]reported that use of immunosuppressive drugs/steroids and co-morbid conditions were associated with PTB. Therefore it is important to periodically screen the patients with chronic conditions like diabetes, those on immunosuppressive drugs/steroids for occurrence of tuberculosis.

In the present study majority 120(60.91%) of TB patients were by EPTB and remaining 77(39.08%) were diagnosed as PTB. A recent study from a large tertiary hospital in south India reported that EPTB showed an increasing trend among HIV infected patients[14]. But in our study all PTB and EPTB patients HIV status was non reactive.

In the present study out of 120 EPTB patients pleural effusion (46.66%) is the most frequent type of EPTB. 25.83% of them were having lymphadenopathy of cervical, supraclavicular, submandibular, axillary and femoral. In lymph node involvement majority 23(19.16%) had cervical lymph node involvement. Another study conducted in India also showed the commonest sites of EPTB were lymph node (34.4%) and pleural effusion (25.2%) followed by abdominal (12.8%) and central nervous system (CNS) (9.4%).[24] Another study conducted in Karnataka revealed Extra-pulmonary cases accounted for 30.5% of total TB cases. Among 224 cases of extra-pulmonary TB studied, 136 (60.7%) were males and 88 (39.3%) were females. Most common site of extra-pulmonary tuberculosis was pleura (29.9%) followed by meninges (22.5%), abdomen (19.6%) and lymph node (10.7%) tuberculosis.[26]

Out of 77 PTB patients 62(80.59%) of them has completed the TB treatment and remaining 15(19.48%) has not completed the TB treatment. Out of 120 EPTB patients 88(73.33%) has completed the TB treatment and remaining 32(26.66%) has not completed the treatment.

Out of 77 PTB patients 72(93.50%) were survivors and remaining 8(4.06%) of them died due to PTB. Among 120 EPTB patients 117(97.45%) were survivors and remaining 3(2.05%) of them died due to complication of EPTB. A study conducted in Uzbekistan reported overall, 83% of patients were successfully treated, 6% died, 6% were lost-to-follow-up, 3% failed treatment and 2% transferred out[25]. Other study conducted in Karnataka showed 82.2% completed treatment, 7.5% were defaulted, 9.9% died and 0.4% treatment failure. The most common reason for default was irregular treatment (29.5%) followed by alcohol abuse (23.5%).[26]

Conclusion:

The mean treatment success rate of PTB patients was 80.59%and in EPTB was 73.33%) it was not significantly affected by gender, age and type of TB. However, Based on this finding it is recommended to implement frequent supportive supervision during the course of treatment, strengthen referral linkage among facilities, and conduct further research to find out the reasons for the observed difference among PTB and EPTB patients.

References:

1. https://www.who.int/news-room/fact-sheets/detail/tuberculosis
2. https://www.who.int/news/item/14-10-2021-tuberculosis-deaths-rise-for-the-first-time-in-more-than-a-decade-due-to-the-covid-19-pandemic
3. Lee JY. Diagnosis and treatment of extrapulmonary tuberculosis. Tuberc Respir Dis (Seoul). 2015 Apr;78(2):47-55. doi: 10.4046/trd.2015.78.2.47. Epub 2015 Apr 2. PMID: 25861336; PMCID: PMC4388900.

4. https://www.who.int/tb/publications/global_report/gtbr2018_main_text_28Feb2019.pdf
5. Sharma SK, Mohan A. Extrapulmonary tuberculosis. Indian J Med Res. 2004 Oct;120(4):316-53. PMID: 15520485.
6. Ohene SA, Bakker MI, Ojo J, Toonstra A, Awudi D, Klatser P. Extra-pulmonary tuberculosis: A retrospective study of patients in Accra, Ghana. PLoS One. 2019 Jan 9;14(1):e0209650. doi: 10.1371/journal.pone.0209650. PMID: 30625188; PMCID: PMC6326428.
7. Boum, Y., Atwine, D., Orikiriza, P. et al. Male Gender is independently associated with pulmonary tuberculosis among sputum and non-sputum producers people with presumptive tuberculosis in Southwestern Uganda. BMC Infect Dis 14, 638 (2014). https://doi.org/10.1186/s12879-014-0638-5
8. Sreeramareddy, C.T., Panduru, K.V., Verma, S.C. et al. Comparison of pulmonary and extrapulmonary tuberculosis in Nepal- a hospital-based retrospective study. BMC Infect Dis 8, 8 (2008). https://doi.org/10.1186/1471-2334-8-8
9. Hudelson P: Gender differentials in tuberculosis: the role of socio-economic and cultural factors. Tuber Lung Dis. 1996, 77: 391-400. 10.1016/S0962-8479(96)90110-0.
10. Holmes CB, Hausler H, Nunn P: A review of sex differences in the epidemiology of tuberculosis. Int J Tuberc Lung Dis. 1998, 2: 96-104.
11. Martinez AN, Rhee JT, Small PM, Behr MA: Sex differences in the epidemiology of tuberculosis in San Francisco. Int J Tuberc Lung Dis. 2000, 4: 26-31.
12. Chan-Yeung M, Noertjojo K, Chan SL, Tam CM: Sex differences in tuberculosis in Hong Kong. Int J Tuberc Lung Dis. 2002, 6: 11-8.

13. Gonzalez OY, Adams G, Teeter LD, Bui TT, Musser JM, Graviss EA: Extra-pulmonary manifestations in a large metropolitan area with a low incidence of tuberculosis. Int J Tuberc Lung Dis. 2003, 7: 1178-85.
14. Cailhol J, Decludt B, Che D: Sociodemographic factors that contribute to the development of extrapulmonary tuberculosis were identified. J Clin Epidemiol. 2005, 58: 1066-71. 10.1016/j.jclinepi.2005.02.023.
15. Yang Z, Kong Y, Wilson F, Foxman B, Fowler AH, Marrs CF, Cave MD, Bates JH: Identification of risk factors for extra pulmonary tuberculosis. Clin Infect Dis. 2004, 38: 199-205. 10.1086/380644.
16. Musellim B, Erturan S, Sonmez Duman E, Ongen G: Comparison of extra-pulmonary and pulmonary tuberculosis cases: factors influencing the site of reactivation. Int J Tuberc Lung Dis. 2005, 9: 1220-3.
17. Bates MN, Khalakdina A, Pai M, Chang L, Lessa F, Smith KR: Risk of tuberculosis from exposure to tobacco smoke: a systematic review and meta-analysis. Arch Intern Med. 2007, 167: 335-42. 10.1001/archinte.167.4.335.
18. Chiang CY, Slama K, Enarson DA: Associations between tobacco and tuberculosis. Int J Tuberc Lung Dis. 2007, 11: 258-62.
19. Chiang CY, Riley LW: Exogenous reinfection in tuberculosis. Lancet Infect Dis. 2005, 5: 629-36. 10.1016/S1473-3099(05)70240-4
20. Lambert ML, Hasker E, Van Deun A, Roberfroid D, Boelaert M, Van der Stuyft P: Recurrence in tuberculosis: relapse or reinfection?. Lancet Infect Dis. 2003, 3: 282-7. 10.1016/S1473-3099(03)00607-8.
21. Shetty N, Shemko M, Vaz M, D'Souza G: An epidemiological evaluation of risk factors for tuberculosis in South India: a matched case control study. Int J Tuberc Lung Dis. 2006, 10: 80-6.

22. Alisjahbana B, van Crevel R, Sahiratmadja E, den Heijer M, Maya A, Istriana E, Danusantos H, Ottenhof TH, Nelwa RHH, van der Meer JW: Diabetes mellitus is strongly associated with tuberculosis in Indonesia. Int J Tuberc Lung Dis. 2006, 10: 696-700.
23. Jick SS, Lieberman ES, Rahman MU, Choi HK: Glucocorticoid use, other associated factors, and the risk of tuberculosis. Arthritis Rheum. 2006, 55: 19-26. 10.1002/art.21705.13.
24. Cherian JJ, Lobo I, Sukhlecha A, Chawan U, Kshirsagar NA, Nair BL, Sawardekar L. Treatment outcome of extrapulmonary tuberculosis under Revised National Tuberculosis Control Programme. Indian J Tuberc. 2017 Apr;64(2):104-108. doi: 10.1016/j.ijtb.2016.11.028. Epub 2017 Jan 11. PMID: 28410692.
25. Jamshid G. Factors Associated with Unfavorable Treatment Outcomes in New and Previously Treated TB Patients in Uzbekistan: A Five Year Countrywide Study. PLOS ON: June 15, 2015 https://doi.org/10.1371/journal.pone.0128907
26. Ravikumar P et al. International Journal of Advances in Medicine, A study of Extra Pulmonary Tuberculosis and its outcome: 2017 Feb;4(1):209-213 http://www.ijmedicine.com