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Original Research Article

Diagnostic utility of cartridge based nucleic acid amplification test (CBNAAT) in detection of rifampicin resistance in multi drug resistant suspects among sputum positive cases of tuberculosis

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Abstract: Tuberculosis has claimed its victims throughout much of known human history. CBNAAT (Xpert MTB/ RIF) is a fully automated diagnostic test which simultaneously detects tuberculosis and rifampicin drug resistance within few hours. The present study was conducted to show the diagnostic ability of CBNAAT in detecting rifampicin resistance with consideration of the diabetic status. The present study was carried out in the department of Chest and Tuberculosis, Government medical college, Amritsar and included 100 patients diagnosed with tuberculosis as MDR suspects. Most of the patients under study were below 60 years, mostly lying in the age grp <=40years (55%). The study showed that males predominated the study being 72% of the total patients with male: female ratio of 2.6:1. 33% of patients belonged to group II i.e. CAT 2 regimen failure. 27% of the subjects were diabetics (16% male and 11% female). It was found that 52% of the patients fell in weight band – B i.e. weighing between 26 to 45kg while diabetic subjects belonged to weight band of 46-70kg (11%). There was almost equal distribution of subjects in urban (47%) and rural setting (53%). Distribution of diabetics was also almost equal in rural (14%) and urban population (13%). Family history of ATT was present in 17% of the subjects and was found out to be statistically significant (p <.006). Also, family history of ATT was seen in 3% of the diabetics and 14% of the non-diabetics and was found out to be statistically significant (p< .029). Total 26% of the subjects had smoking addiction out of which 5% had diabetes, 59% were alcoholics out of which 15% were diabetic, 6% had tobacco addiction out of which 2% had diabetes and 2% were capsule addicts with non-diabetic status. Thus, majority of subjects in the study are re-treatment cases who are sputum positive at 4 months or later.
Keywords: Tuberculosis, CBNAAT, Diabetes, Rifampicin drug resistance

INTRODUCTION

Tuberculosis (TB) is as old as the mankind [1-3]. In 1993, the World Health Organization (WHO) took an unprecedented step and declared TB to be a global emergency [4-6]. TB is principally a disease of poverty, with 95 per cent of cases and 98 per cent of deaths occurring in developing countries. Of these, more than half the cases occur in five South East Asian countries [7].

Multi-drug-resistant tuberculosis (MDR-TB) is defined as a form of TB infection caused by bacteria that are resistant to treatment with at least two of the most powerful first-line anti-TB drugs [8], isoniazid (INH) and rifampicin (R) with or without resistance to other first line drugs, based on the results from a quality assured laboratory [9].

India is one of the high tuberculosis (TB) burden countries in the world accounting for nearly 20% of the global incidence constituting 9.4 million TB cases. India ranks second in harboring multi drug resistant (MDR)-TB cases, i.e., about 99,000 cases [10]. Five percent (5%) of all TB cases across the globe in 2013 were estimated to be MDR-TB cases, including 3.5% of newly diagnosed TB cases, and 20.5% of previously treated TB cases [8].

MDR-TB infection may be classified as either primary or acquired. Primary MDR-TB occurs in patients who have not previously been infected with TB

but who become infected with a strain that is resistant to treatment. Acquired MDR-TB occurs in patients during treatment with a drug regimen that is not effective at killing the particular strain of TB with which they have been infected [11].

Most cases of acquired MDR-TB are due to inappropriate treatment. This can occur due to a medical provider, such as a doctor or nurse, improperly prescribing ineffective treatment, but may also be due to the patient not taking the medication correctly, which can be due to a variety of reasons, including expense or scarcity of medicines, patient forgetfulness, or patient stopping treatment early because they feel better [12].

A possibility is, as has been recently shown in patients with T2DM (Type 2 Diabetes mellitus), that diabetes patients do not achieve or maintain adequate blood levels of rifampicin, one of the foundation drugs of the DOTS regime. However, failure to comply with therapy or to metabolize drugs effectively would result in secondary resistance; that is, resistance developing later in the course of treatment in a patient who initially had a sensitive strain [13, 14].

One test, Gene Xpert® MTB/RIF, which was recently endorsed by the World Health Organization (WHO), has the potential to lead a revolution in the diagnosis of active TB disease and multidrug-resistant (MDR) TB. Gene Xpert test is a semi-quantitative nested real-time PCR in-vitro diagnostic test with two uses: (1) The detection of Mycobacterium tuberculosis complex DNA in sputum samples or concentrated sediments prepared from induced or expectorated sputum that are either acid-fast bacilli (AFB) smear positive or negative. (2) The detection of Rifampicin resistance associated mutations of the rpoB gene in samples from patients of Rifampicin resistance [15, 16].

The MTB/RIF test is easy to perform and is less dependent on the user's skills. Routine staff with minimal training can use the test. Technicians can be trained in 1-2 days. Only 2 steps (addition of buffer and sputum sample) are manual and the rest of the steps are automated. The results are available within 90 minutes. Each table top-sized module can process 4 samples daily (larger modules can run 200 tests in an 8-hour day), and because it is a closed system, biosafety and contamination concerns are minimized [17].

The present study aims to identify DR-TB cases earlier than the previous methods used and to depict the trend of emergence of rifampicin resistance in multi drug resistant suspects with sputum positive pulmonary tuberculosis.

MATERIAL AND METHODS

The present study was an observational prospective study which was carried out in the department of Chest and Tuberculosis, Government medical college, Amritsar with permission of ethical committee. The study included 100 patients diagnosed with tuberculosis coming to outpatient department or admitted in wards on re-treatment basis as MDR suspects.

Patients with sputum positive pulmonary and/or extra pulmonary tuberculosis with age greater than 20 years, CAT 1 regimen failure, CAT 2 regimen failure, relapse after completion of therapy, treatment default, contact of confirmed MDR case, and having valid address and valid consent were included in the study. Patients taking anti-tuberculosis treatment for first time in life, patients with sputum negative pulmonary tuberculosis, patients with age less than 20 years, patients already taking treatment for multi drug resistant tuberculosis and patients with Human immunodeficiency virus infection were excluded from the study.

The patients were grouped under five headings: Group I: Patients with CAT 1 regimen failure (sputum smear positive at 5 months or later during treatment.) Group II: Patients with CAT 2 regimen failure (sputum smear positive at 4 months or later during treatment.) Group III: Sputum positive patients with relapse after completion of therapy. Group IV: Sputum positive patients with treatment default whose treatment was interrupted for 2 consecutive months or more. Group V: Sputum positive patients who are contacts of confirmed MDR cases. Further, Groups I to V were divided into following subgroups: Diabetic patients and Non-diabetic patients.

Complete history was taken with emphasis on history of anti-tubercular therapy and general physical and systemic examination of the cardiovascular, respiratory, and abdominal and central nervous system was performed. Necessary investigations were carried out to diagnose the cases that fit into inclusion criteria.

All sputum specimens were collected in pre-sterilized falcon tubes and packed using standard three layer packing system. The specimen was transported in cold chain through the locally feasible transport system like courier, speed post, human carrier etc. The specimens collected and packed at the collection centres were sent to the linked cartridge based nucleic acid amplification test (CB-NAAT) laboratory preferably in cold chain on the same day along with correctly filled request for culture and drug sensitivity testing(C-DST) form from the referring facilities. On the receipt of the specimen, the LT was required to process the specimen. The results were available within 1 hour and 45

minutes. The results of all cases detected with MTB positive and Rif Resistance were communicated to the District TB Officer with copy to the linked drug resistant tuberculosis (DR-TB) Centre and the consultant concerned. The results were collaborated in a tally sheet.

For all specimens with mycobacterium tuberculosis negative and rifampicin indeterminate results, fresh specimen needed to be sent to the nearest revised national tuberculosis control programme (RNTCP) certified culture and drug senstivity testing (DST) laboratory for reconfirmation preferably by line probe assay (LPA). All the data obtained was statistically analysed by Chi-square test on SPSS version 17.0 and put into a tabular form.

RESULTS

Our study included 100 patients diagnosed with tuberculosis coming to outpatient department or admitted in wards on re-treatment basis as MDR suspects. Most of the patients under study were below 60 years, mostly lying in the age grp <=40years (55%) and others lying in age group 41-60years (41%). 33% of patients belonged to group II i.e. CAT 2 regimen failure (sputum smear positive at 4 months or later during treatment). The study showed that males predominated the study being 72% of the total patients. Whereas females constituted 28%. The male: female ratio was 2.6:1. It was found that 52% of the patients fell in weight band – B i.e. weighing between 26 to 45kg. Hence, most of the MDR suspects were underweight and malnourished. It was concluded from the study that there was almost equal distribution of subjects in urban and rural setting, incidence being slightly higher in rural population (53%) than in urban population (47%).

This study cleared that, 27% of the subjects were diabetics and 73% of the study group population was non-diabetic. The distribution was found equally in grp-2 (n=10) and grp-3 (n=10) patients. Family history of ATT was present in 17% of the subjects and was present in all groups almost equally and was found out to be statistically significant (p <.006).

The above study showed that total 26% of the subjects had smoking addiction while majority were non-smokers (74%). The frequency of smoking was maximum in grp-2 (n=8) followed closely by grp-3 (n=7) and grp-4 (n=6). The alcoholics in the group ranged upto 59% of the total study subjects and it seemed to be a major addiction. Whereas non-alcoholics contributed 41%. As seen from study, tobacco addiction was seen in mere 6% of the patients. This addiction seemed to be less prevalent in the area where the study was conducted. It's clear from the above depiction that capsule addiction was found in minority of the study group patients. It was present in only 2% of the patients.

The observation from the above study showed that, 27% of the study subjects were diabetics with equal distribution in grp-2 (n=10) and grp-3 (n=10); maximum number of diabetics were seen in age group of 41-60 years (20%). It was observed from the above study that, out of 100 patients, 16 (16%) were male diabetics and 11 (11%) were female diabetics. Rest 77 (77%) were non diabetics. Most of the diabetic subjects belonged to weight band of 46-70kg (11%) and 26-45kg (10%) followed by weight band >60kg which constituted 6% of study group population. Distribution of diabetics was almost equal in rural and urban population being 14% in rural study subjects and 13% in urban study subjects. It's clear from the above study that family history of ATT was seen in 3% of the diabetics and 14% of the non-diabetics. The number of cases with family h/o ATT were distributed equally in grp-1 (n=4), grp-3 (n=4) and grp-4 (n=4) and was found out to be statistically significant (p< .029).

It can be concluded from the above that 5% of smokers were diabetics among the study population. Whereas 21% of smokers were seen in non-diabetic population. The maximum number of smokers (including both diabetics and non-diabetics) were present in grp-2 (n=10). It is concluded that 15% of alcoholics were seen in diabetic study population. Whereas 44% of alcoholics were seen in non-diabetic population. Most of the alcoholics (including both diabetics and non-diabetics) were seen in grp-3 (n=22). As seen in the above study, tobacco addicts accounted for 2% in the diabetic study population. Whereas in non-diabetic population, tobacco addiction was seen in 4% of the cases. It was found maximum in grp-2 (n=3) and grp-3 (n=3). Capsule addiction was not found in diabetics. Whereas it was found in 2% cases among non-diabetics.

Table-1: Distribution of the study subjects based on patient's age

Age grp (in years)	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
<=40	16	18	14	6	1	55 (55%)
41-60	6	13	16	5	1	41 (41%)
>60	0	2	2	0	0	4 (4%)
Total	22	33	32	11	2	100 (100%)

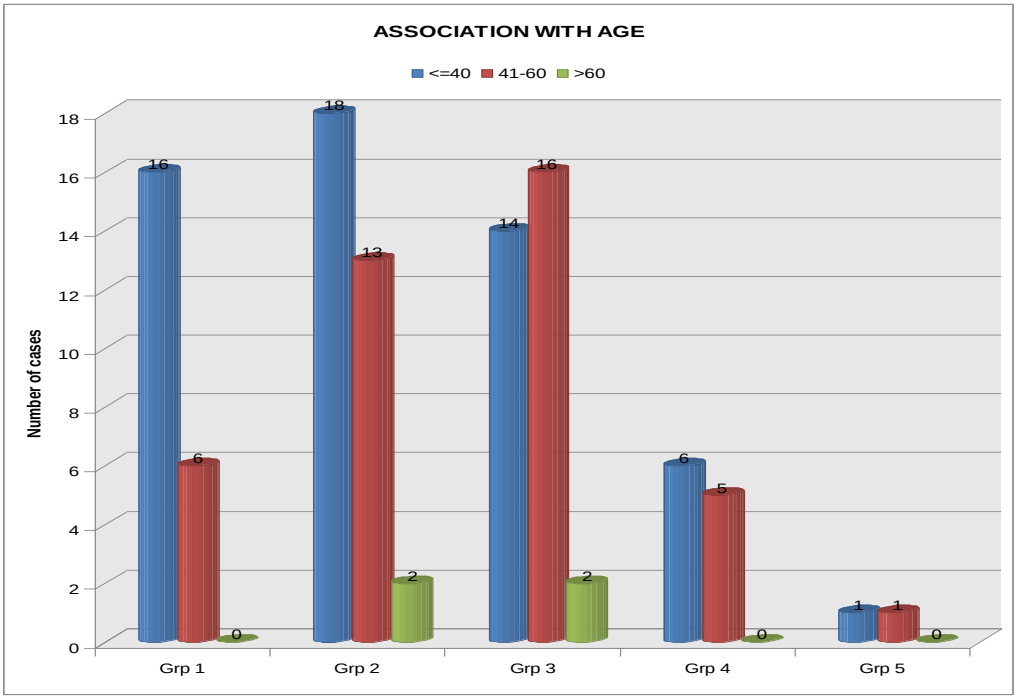
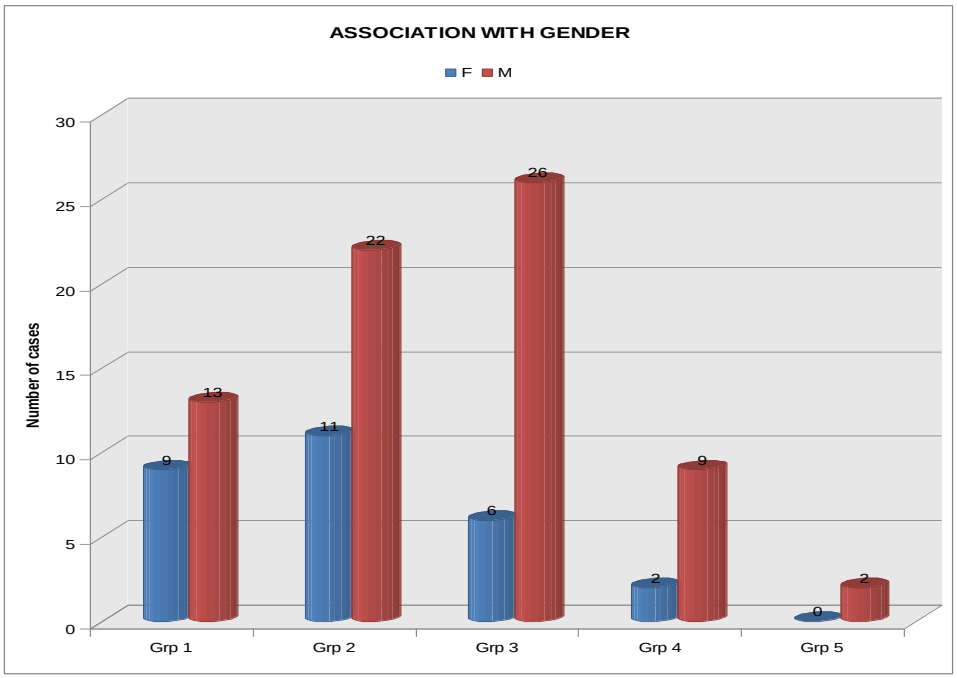


Fig-1: Distribution of the study subjects based on patient's age

Table-2: Gender wise distribution of patients

Sex	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
F	9	11	6	2	0	28 (28%)
M	13	22	26	9	2	72 (72%)
Total	22	33	32	11	2	100 (100%)

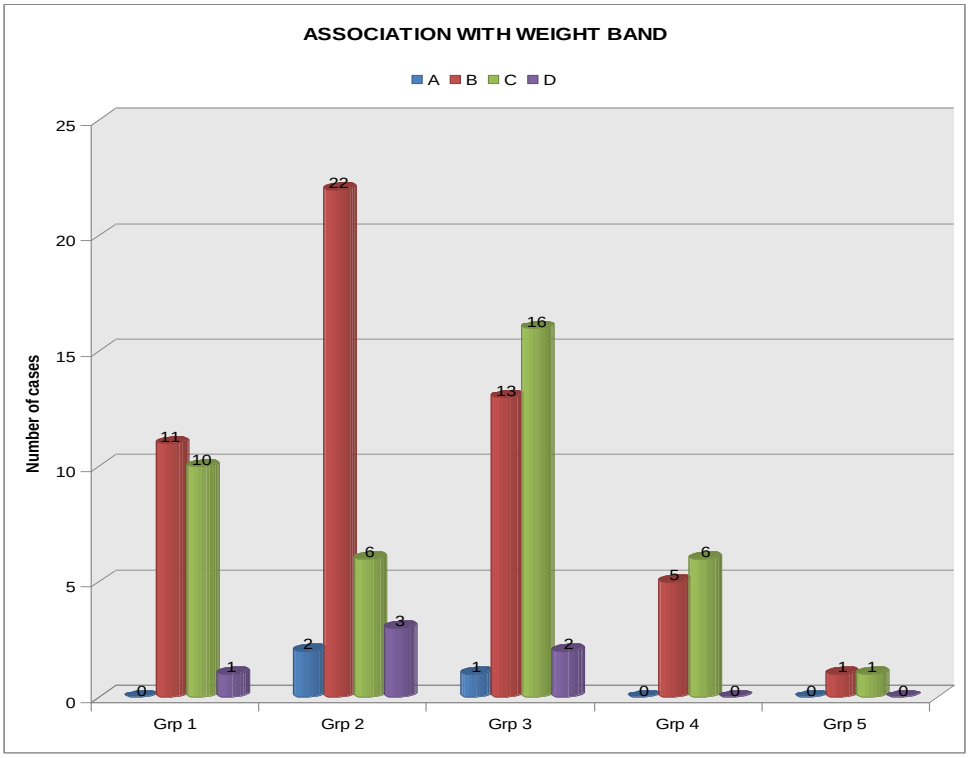


Where F – Female; M - Male

Fig-2: Gender wise distribution of patients

Table-3: Distribution of patients as per weight band

Weight band	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
A	0	2	1	0	0	3 (3%)
B	11	22	13	5	1	52 (52%)
C	10	6	16	6	1	39 (39%)
D	1	3	2	0	0	6 (6%)
Total	22	33	32	11	2	100 (100%)

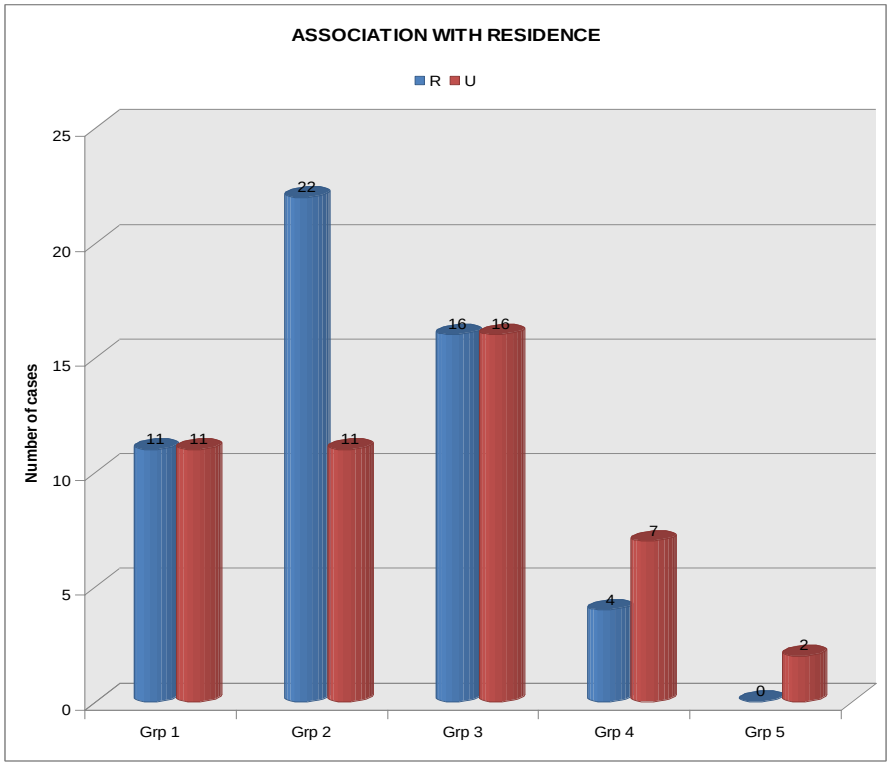


Where A - <26kg; B - 26-45kg; C - 46-70kg; D- >70kg

Fig-3: Distribution of patients as per weight band

Table-4: Area wise distribution of the patients

Residency	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
R	11	22	16	4	0	53 (53%)
U	11	11	16	7	2	47 (47%)
Total	22	33	32	11	2	100 (100%)

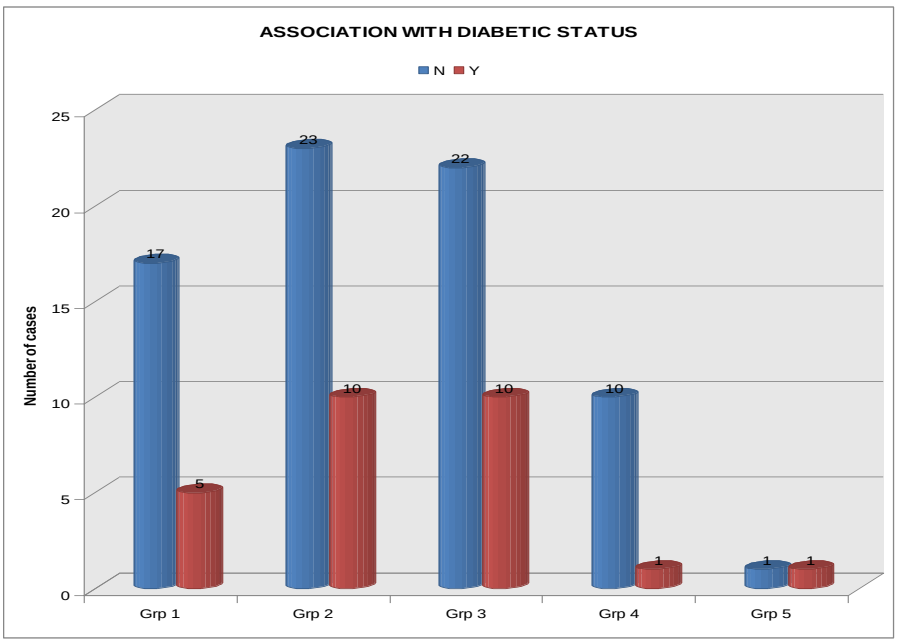


Where R- Rural; U –Urban

Fig-4: Area wise distribution of the patients

Table-5: Association with diabetic status

Diabetic	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	17	23	22	10	1	73 (73%)
Y	5	10	10	1	1	27 (27%)
Total	22	33	32	11	2	100 (100%)

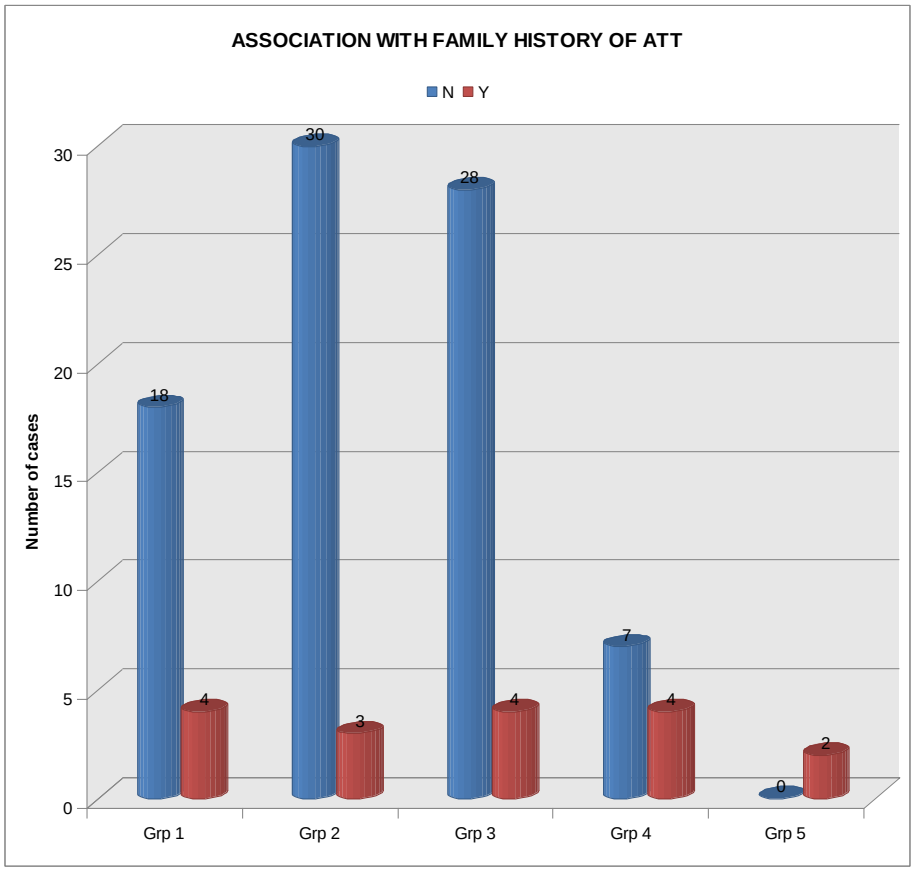


Where N - No; Y - Yes

Fig-5: Association with diabetic status

Table-6: Association with family h/o ATT

Family h/o ATT	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	18	30	28	7	0	83 (83%)
Y	4	3	4	4	2	17 (17%)
Total	22	33	32	11	2	100 (100%)



Where N – No; Y – Yes

Fig-6: Association with family h/o ATT

Table-7: Smoking status in various groups

Smoker	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	18	25	25	5	1	74 (74%)
Yes	4	8	7	6	1	26 (26%)
Total	22	33	32	11	2	100 (100%)

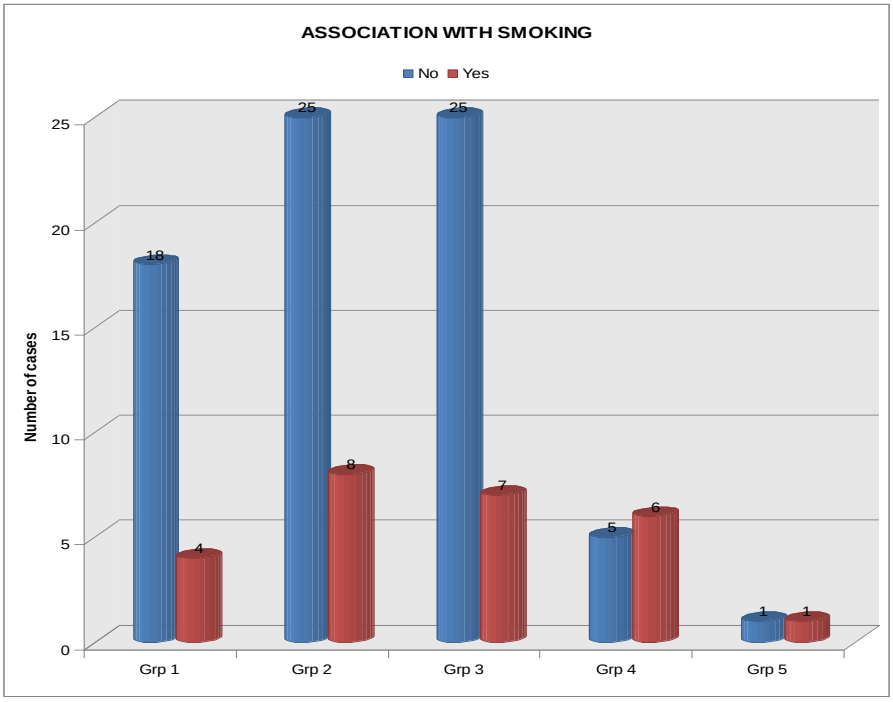


Fig-7: Smoking status in various groups

Table-8: Alcohol addiction in the study subjects

Alcoholic	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	11	17	10	2	1	41 (41%)
Yes	11	16	22	9	1	59 (59%)
Total	22	33	32	11	2	100 (100%)

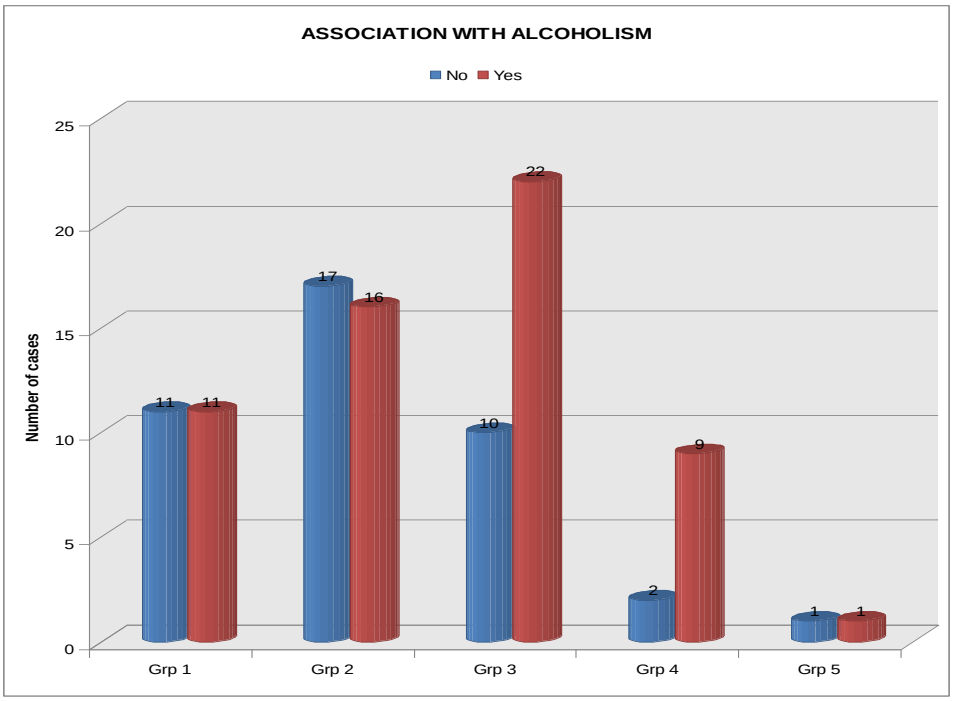


Fig-8: Alcohol addiction in the study subjects

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Table-9: Distribution of tobacco addicts

Tobacco addict	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	22	30	29	11	2	94 (94%)
Yes	0	3	3	0	0	6 (6%)
Total	22	33	32	11	2	100 (100%)

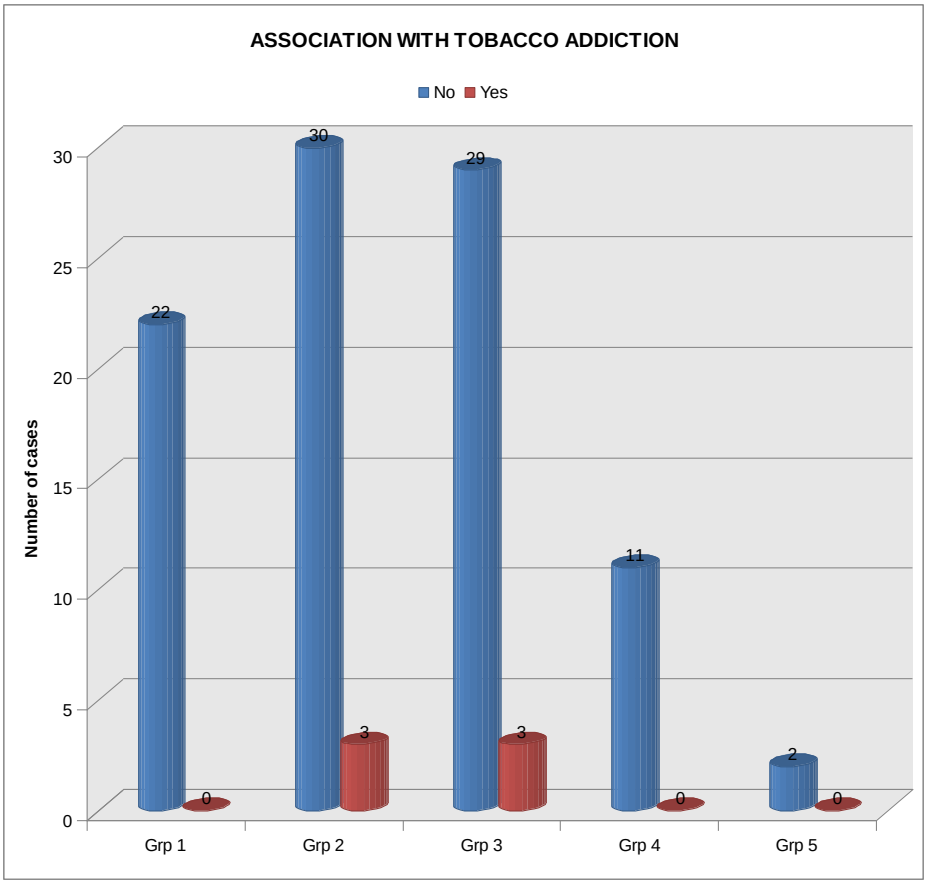


Fig-9: Distribution of tobacco addicts

Table-10: Presence of capsule addiction in the patients

Capsule addict	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	21	33	31	11	2	98 (98%)
Yes	1	0	1	0	0	2 (2%)
Total	22	33	32	11	2	100 (100%)

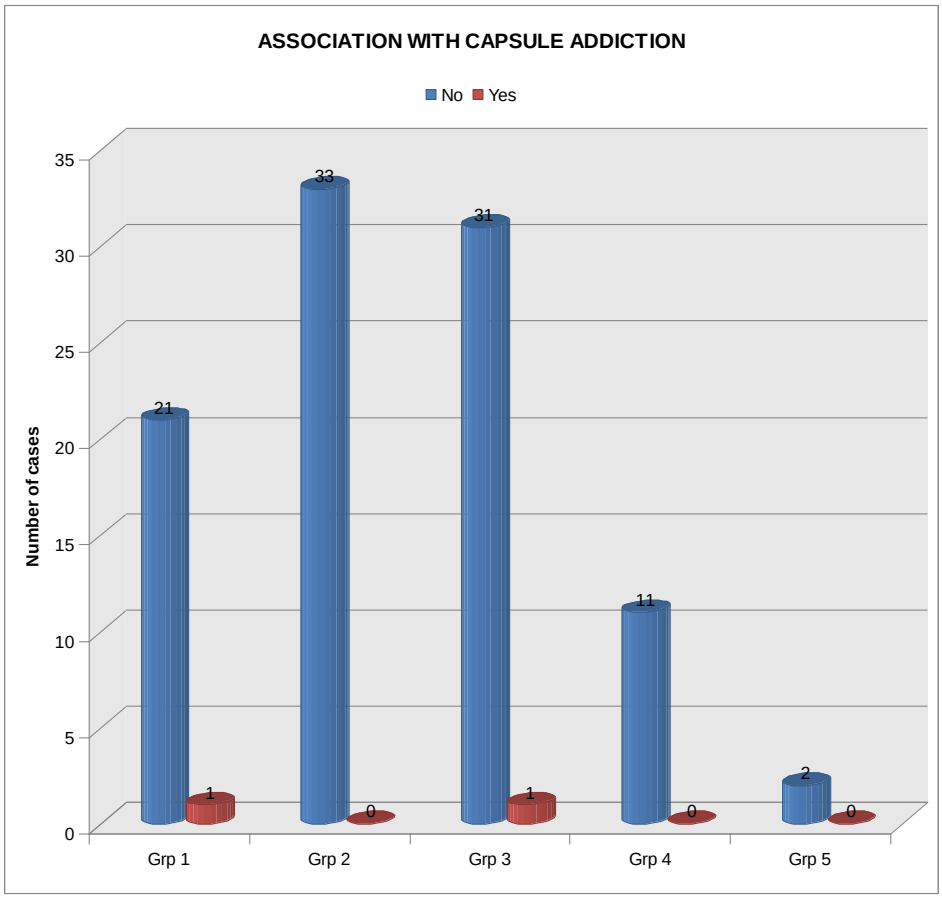


Fig-10: Presence of capsule addiction in the patients

Table-11: Association with age and diabetic status

Diabetic	Age grp (in years)	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	<=40	14	18	12	6	1	51 (51%)
	41-60	3	5	9	4	0	21 (21%)
	>60	0	0	1	0	0	1 (1%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	<=40	2	0	2	0	0	4 (4%)
	41-60	3	8	7	1	1	20 (20%)
	>60	0	2	1	0	0	3 (3%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

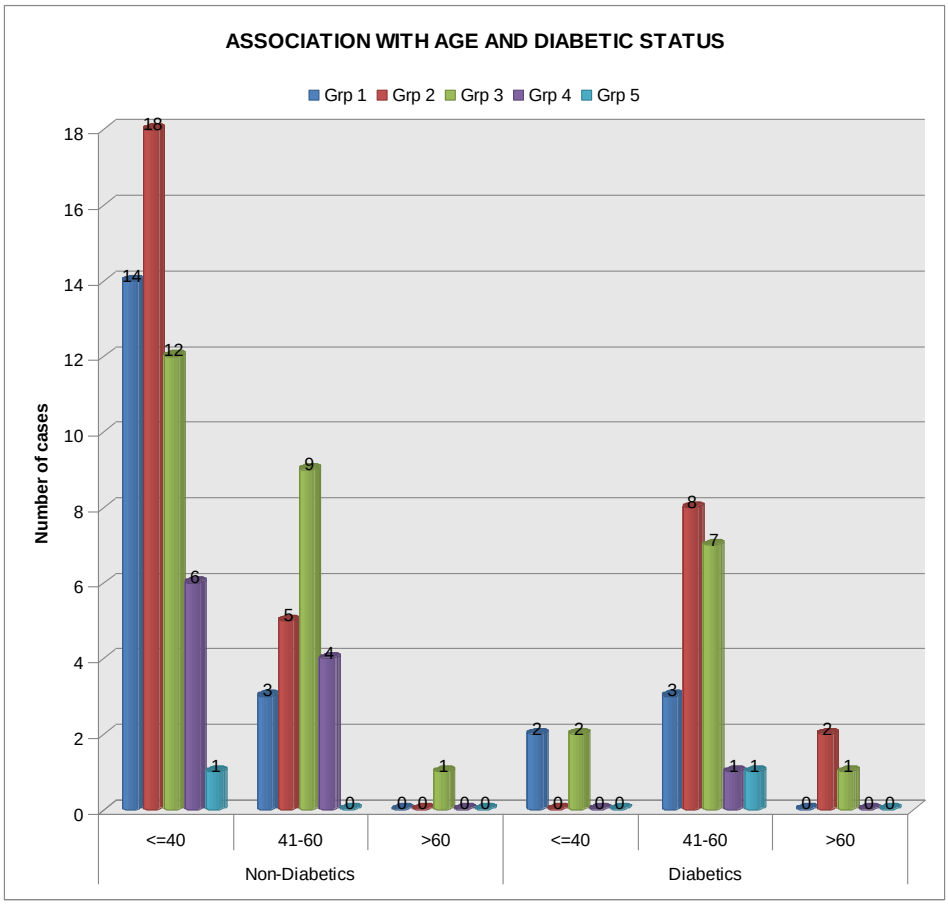


Fig-11: Association with age and diabetic status

Table-12: Gender distribution in diabetics of the study

Diabetic	Sex	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	F	5	6	4	2	0	17 (17%)
	M	12	17	18	8	1	56 (56%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Yes	F	4	5	2	0	0	11 (11%)
	M	1	5	8	1	1	16 (16%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

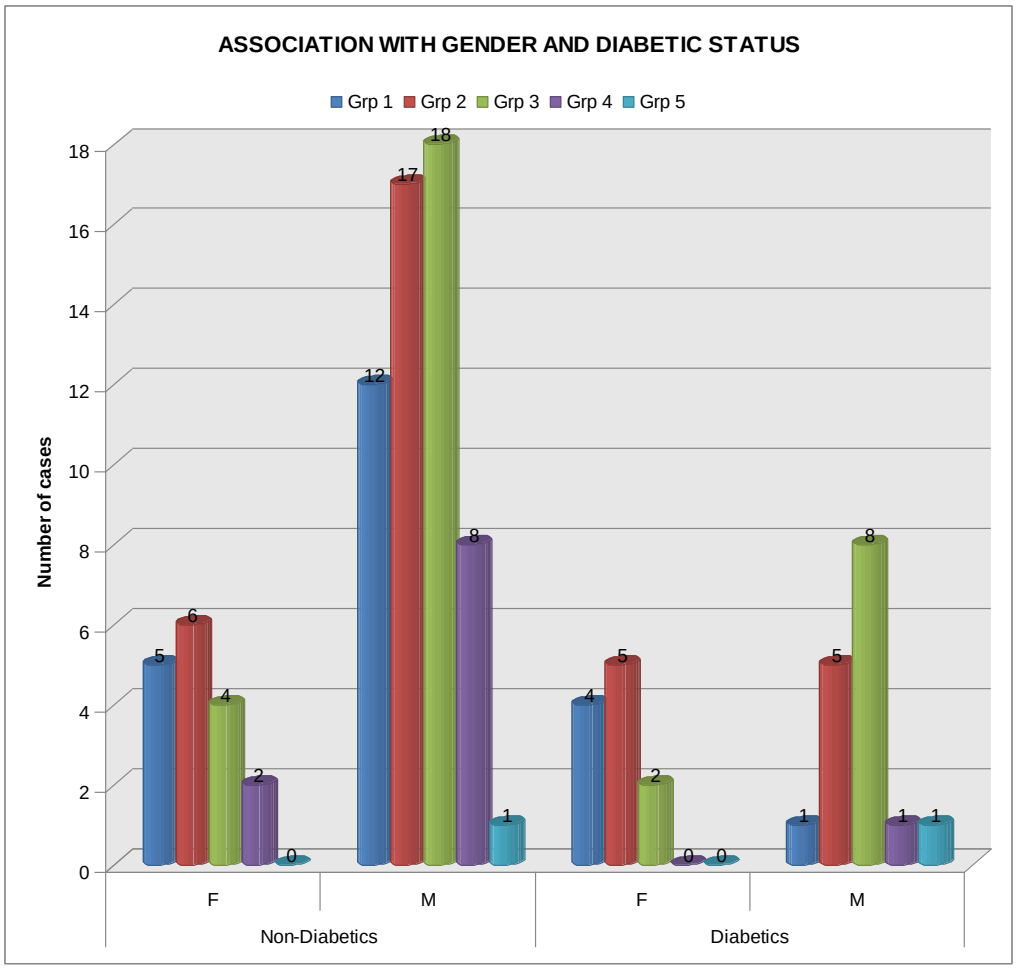
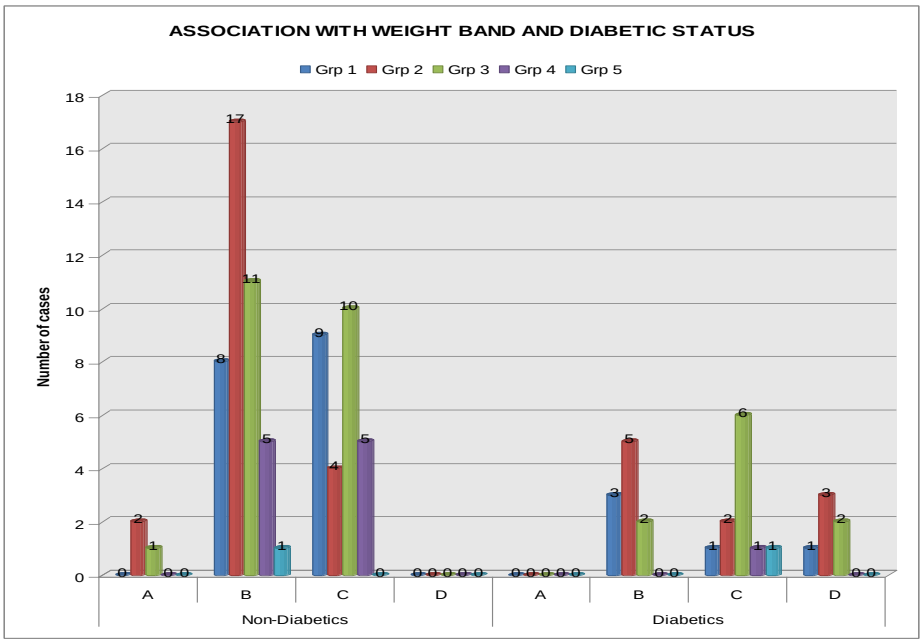


Fig-12: Gender distribution in diabetics of the study

Table-13: Weight band distribution among diabetics

Diabetic	Weight band	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	A	0	2	1	0	0	3 (3%)
	B	8	17	11	5	1	42 (42%)
	C	9	4	10	5	0	28 (28%)
	D	0	0	0	0	0	0 (0%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Yes	A	0	0	0	0	0	0 (0%)
	B	3	5	2	0	0	10 (10%)
	C	1	2	6	1	1	11 (11%)
	D	1	3	2	0	0	6 (6%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

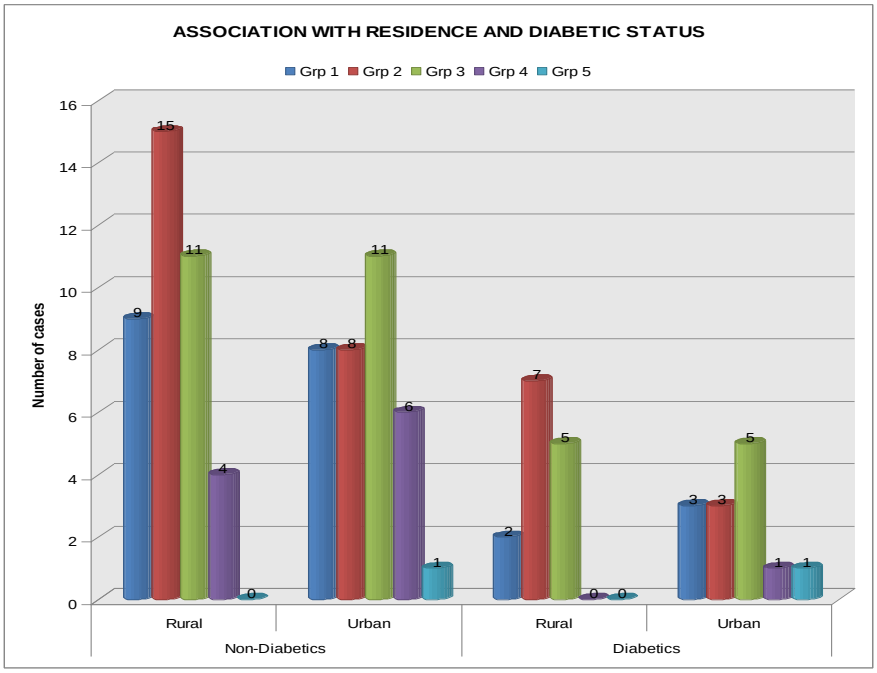


Where A - <26kg; B - 26-45kg; C - 46-70kg; D- >70kg

Fig-13: Weight band distribution among diabetics

Table-14: Area wise Distribution among diabetics

Diabetics	Residency	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	R	9	15	11	4	0	39 (39%)
	U	8	8	11	6	1	34 (34%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	R	2	7	5	0	0	14 (14%)
	U	3	3	5	1	1	13 (13%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**



Where R- Rural; U –Urban

Fig-14: Area wise Distribution among diabetics

Table-15: Association between diabetics and their family h/o ATT

Diabetic	Family h/o ATT	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
No	N	13	20	20	6	0	59 (59%)
	Y	4	3	2	4	1	14 (14%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Yes	N	5	10	8	1	0	24 (24%)
	Y	0	0	2	0	1	3 (3%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

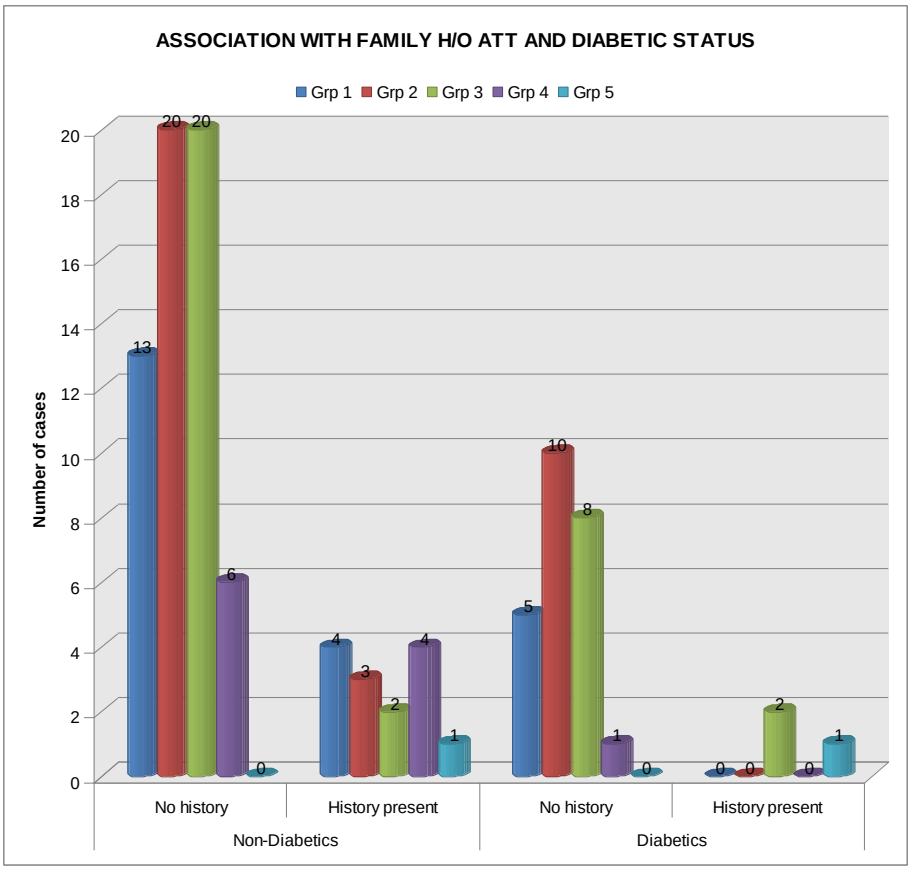


Fig-15: Association between diabetics and their family h/o ATT

Table-16: Distribution of smokers among diabetics

Diabetic	Smoker	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	N	14	17	16	4	1	52 (52%)
	Y	3	6	6	6	0	21 (21%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	N	4	8	9	1	0	22 (22%)
	Y	1	2	1	0	1	5 (5%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

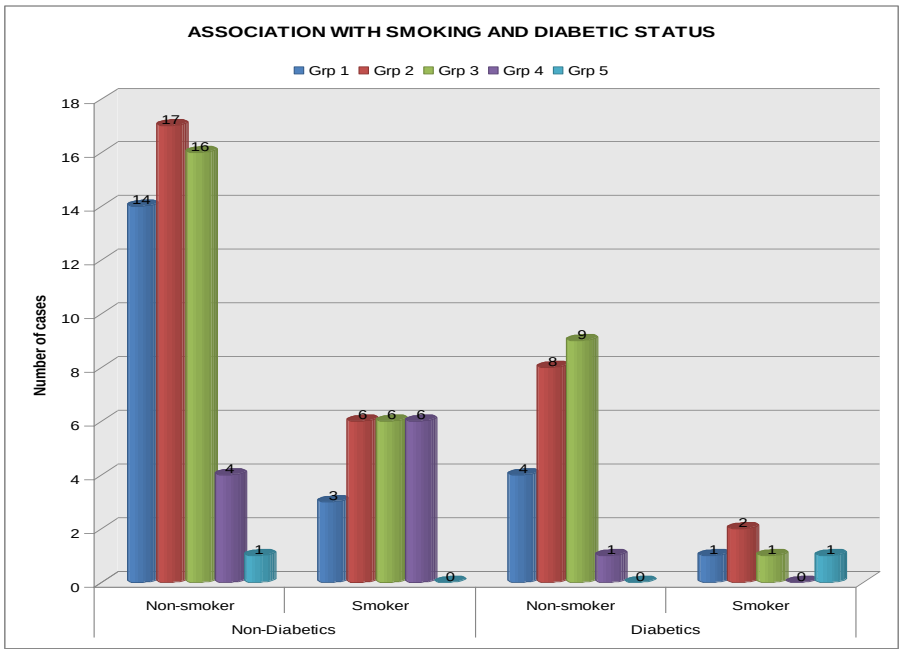


Fig-16: Distribution of smokers among diabetics

Table-17: Association between diabetics and alcoholics

Diabetic	Alcoholic	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	N	7	12	7	2	1	29 (29%)
	Y	10	11	15	8	0	44 (44%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	N	4	5	3	0	0	12 (12%)
	Y	1	5	7	1	1	15 (15%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

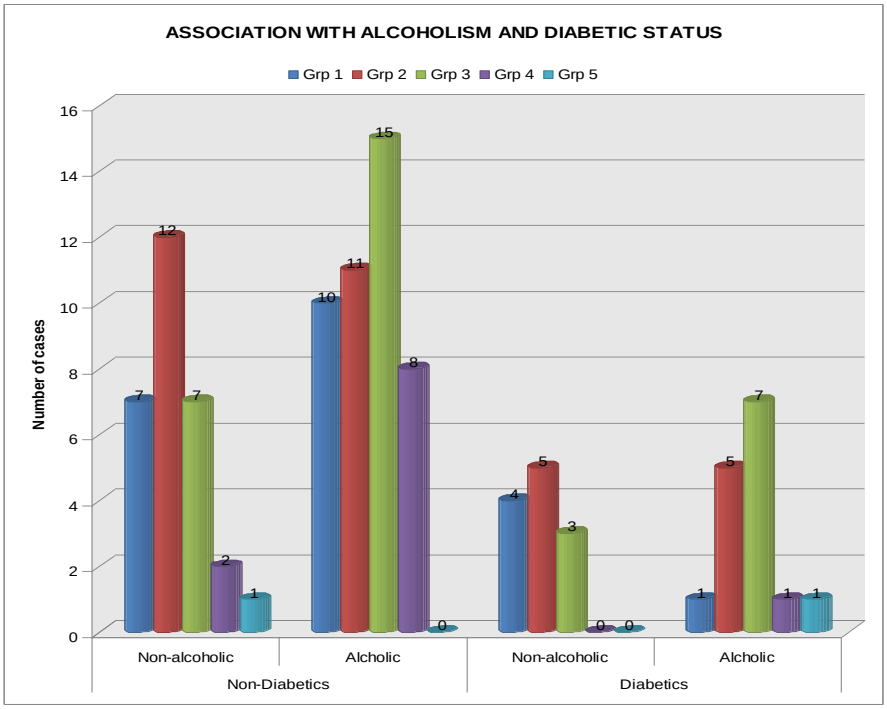


Fig-17: Association between diabetics and alcoholics

Table-18: Distribution of tobacco addicts among diabetic study population

Diabetic	Tobacco addict	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	N	17	21	20	10	1	69 (69%)
	Y	0	2	2	0	0	4 (4%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	N	5	9	9	1	1	25 (25%)
	Y	0	1	1	0	0	2 (2%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

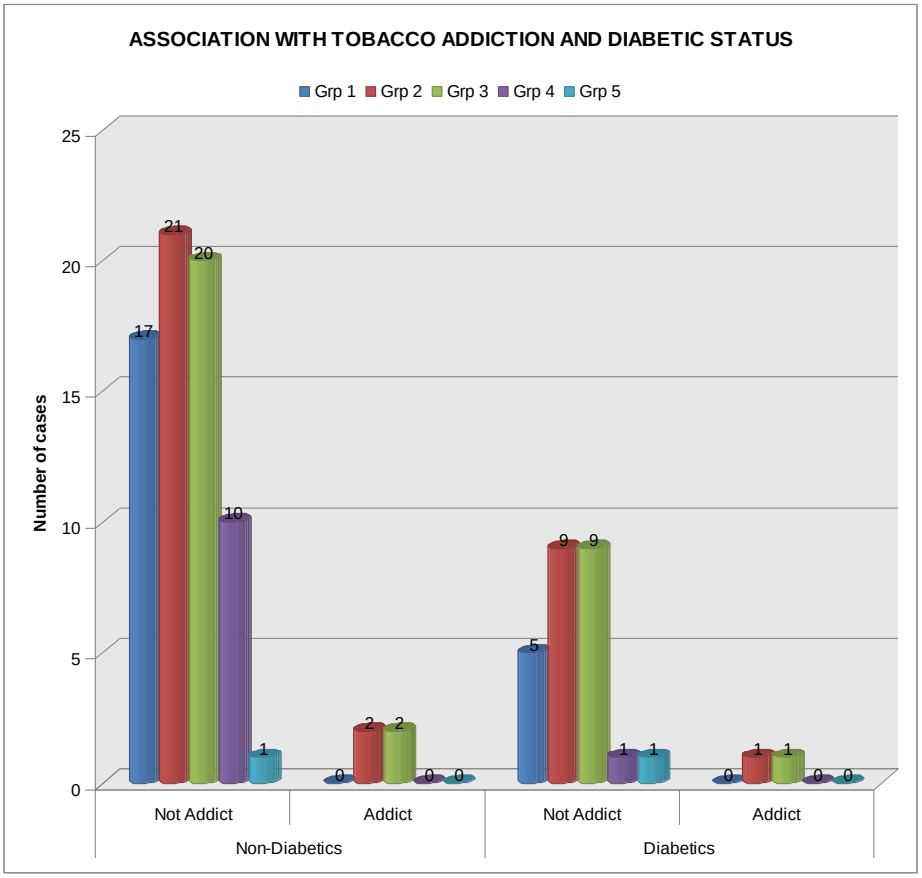


Fig-18: Distribution of tobacco addicts among diabetic study population

Table-19: Association of capsule addiction with diabetic population

Diabetic	Capsule addict	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Total (percentage)
N	N	16	23	21	10	1	71 (71%)
	Y	1	0	1	0	0	2 (2%)
Total		**17**	**23**	**22**	**10**	**1**	**73 (73%)**
Y	N	5	10	10	1	1	27 (27%)
	Y	0	0	0	0	0	0 (0%)
Total		**5**	**10**	**10**	**1**	**1**	**27 (27%)**

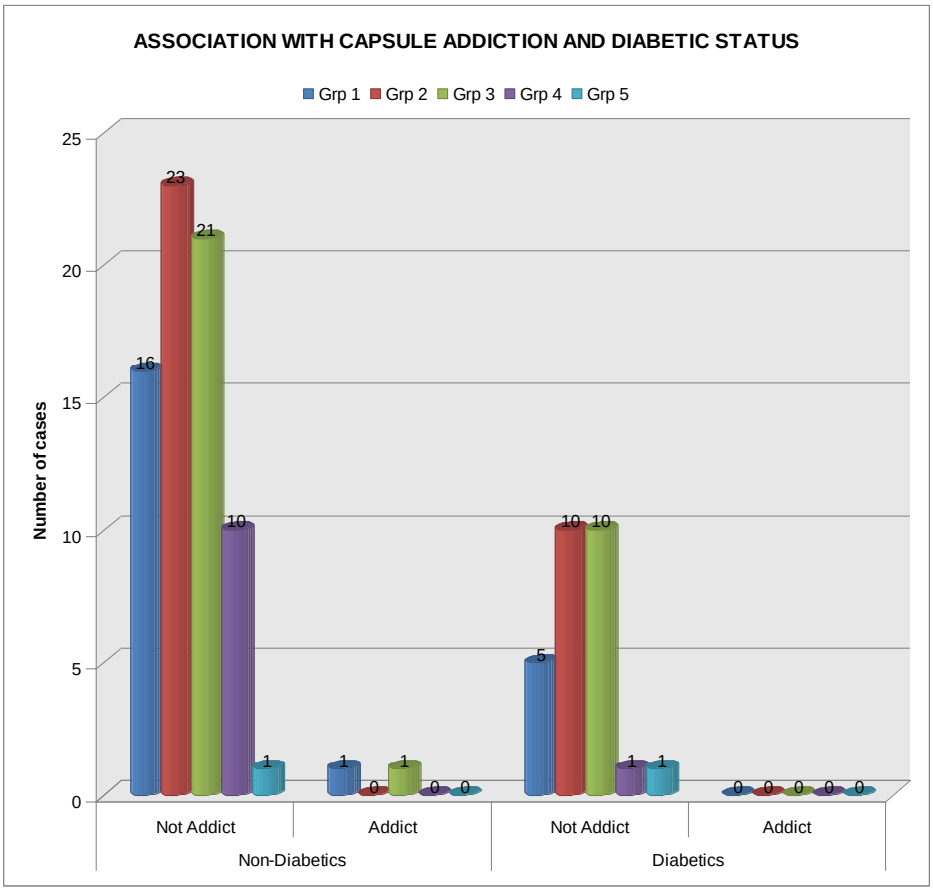


Fig-19: Association of capsule addiction with diabetic population

DISCUSSION

From multiple, commercially available nucleic acid amplification tests (NAAT), a new fully automated platform, endorsed by WHO in 2010, permits rapid detection (<2 hours) outside of the conventional laboratory and requires only minimal healthcare skills [18]. The test also detects MDR-TB and TB cases complicated by HIV, which are more difficult to diagnose. NAAT identifies mutations in the rpoBgene which code for resistance to rifamycin and, because this most often coincides with isoniazid resistance, serves as a surrogate marker for MD [19].

In the present study, 72% of the study population constituted male subjects and remaining 28% were females.

A cross-sectional study was carried out on 81 MDR-TB patients registered under RNTCP of Ahmedabad city during July 2007-June 2008. More than 2/3rd were males and majority were in age group 16-45 years [20].

In the present study, 55% of the study group population was of age <=40 years and 41% of the population had ages ranging between 40-60 years. The most common weight band found in the study was weight band-B i.e. weight between 26 to 45 kg. The residency in urban and rural set up had equal distribution.

All newly diagnosed patients with pulmonary MDR-TB from August 2002 to December 2004 enrolled at New Delhi Tuberculosis Centre were included in the study. Out of total 27 bacteriologically proven cases of MDR-TB included in this study, 19 were males (mean age and weight 38.5 years and 52.6 kgs, respectively) and eight females (mean age and weight 34.3 years and 40.7 kgs, respectively). A majority (18) were residents of Delhi and the rest hailed from different parts of North India[21].

In the present study, the group having maximum number of patients included the group with category 2 treatment failure i.e. group 2 (33%).

Two hundred and twenty four patients with Category-II treatment failure of pulmonary tuberculosis were enrolled from Department of Pulmonary Medicine, at Chatrapati Sahuji Maharaj Medical University, UP, Lucknow, India, from August 2003 to July 2008. The reasons for inclusion of these 224 cases in the Category II regimen were treatment failure in the

previous regimen (n = 75, 33%), default in 57% (n = 129 cases), and relapse in 8.9% (n = 20 cases) [22].

In the present study, 27% of the study group population was found to be diabetic. The maximum number of diabetics were seen in group 2 (n=10) and in group 3 (n=10).

A case-control study was set in central, district and sub-district level hospitals of rural and urban Bangladesh. Included were 250 multidrug resistant tuberculosis (MDR-TB) patients as cases and 750 drug susceptible tuberculosis patients as controls. Previous treatment history was shown to be the major contributing factor to MDR-TB in univariate analysis. After adjusting for other factors in multivariable analysis, age group "18–25" (OR 1.77, CI 1.07–2.93) and "26–45" (OR 1.72, CI 1.12–2.66), some level of education (OR 1.94, CI 1.32–2.85), service and business as occupation (OR 2.88, CI 1.29–6.44; OR 3.71, CI 1.59–8.66, respectively), smoking history (OR 1.58, CI 0.99–2.5), and type 2 diabetes (OR 2.56 CI 1.51–4.34) were associated with MDR-TB [23].

In the present study, family h/o ATT was seen in 17% of the study group population (p< .006) and was found to be statistically significant. Family h/o ATT was almost equally distributed in group 1(n=4), group 2(n=3), group 3(n=4), group 4(n=4) and group 5(n=2).

A study was carried out in Pulmonology Department of Khyber Teaching Hospital, Peshawar, from December 2006 to October 2007. A total of 30 patients of MDR-TB were interviewed. Male (n=17) and female (n=13) ratio was 1.3:1. Mean age was 34.2+/-15.3 years. Ninety-two percent female and 52.9% male were uneducated. All patients had previous history of Antituberculous Treatment (ATT), in which 20% had undertaken ATT course once, 53.3% twice and 26.7% thrice in the past. Seven (23.3%) patients had family history of TB but no one had documented MDR-TB in the family [24]. In the present study, 59% of the study population constituted of alcoholics.

A study was carried out to investigate the association between alcohol consumption during MDR-TB treatment and adverse events and treatment outcomes in a cohort of patients in Tomsk, Russia. From 2000 to 2004, retrospective data were collected on 407 MDR-TB patients in Tomsk. Of the 407 patients, 253 (62.2%) consumed alcohol during treatment ('drinkers'). No significant differences were noted in frequency of adverse events in drinkers vs. non-drinkers. Drinkers had less favourable treatment outcomes (OR 0.28, 95%CI 0.18-0.45) [25].

In the present study, smokers constituted 39% of the total study population. A retrospective study including analysis of a cohort of hospitalised patients with MDR-TB treated in a clinic in Istanbul, Turkey between February 2000 and March 2005 was done. Of 103 MDR-TB patients, 81 (78.6%) were male and the mean age was 40.50±13.50 years (range 14-72) and all were HIV negative. Extensive radiologic involvement was evident in 22 cases (21.4%). Among the cohort, 34 (33%) were current smokers, and 27 (26.2%) were former smokers. In the group with a successful outcome, the mean cigarette consumption was 14.7±19.9 pack years, whereas in the group with a poor outcome it was 40.5±44.4 and the difference was statistically significant (p=0.0001) [26]. In the current study, capsule addiction was found to be in 2% of the cases under study.

In rural areas of desert of western Rajasthan crude opium is consumed with a social sanction by a notable proportion (7.1%) of adult males. It is believed that prevalence of opium addiction is high in TB cases as they may use it to suppress cough. Prevalence of opium addiction among TB cases from rural desert (16.1%) was compared with that in general population (7.1%) and the difference was found significant (X2 = 11.6, p > 0.001) [27].

In the present study, most of the study group population of diabetics fell in category of 41-60 years age group (20%). Male gender (16%) surpassed the female gender (11%) among diabetic cases of the study. The weight band most commonly seen in study group population among diabetics was weight band C (46-70kg) seen in 11% of cases and weight band B (26-45kg) seen in 10% cases. There was equal distribution of diabetics with tuberculosis in urban (13%) and rural (14%) setting. Family h/o ATT in diabetics with tuberculosis was seen in 3% of the cases which is found to be statistically significant (p< .029). The smoking, alcohol, tobacco and capsule addiction was found in 5%, 15%, 2% and 0% cases respectively in diabetics with tuberculosis.

A facility-based cross-sectional study was undertaken in four randomly selected peripheral health institutions (PHI) out of 14 urban PHIs providing DOTS therapy for TB patients in Puducherry. Out of the 223 subjects enrolled for this study, complete details and fasting blood sugar values were available for 217 subjects of which 45 (20.7%) were females. The mean age for males and females was 44.9 ± 12.9 and 36.2 ± 16.2 years, respectively. Using the diagnostic criteria, the prevalence of diabetes among TB patients in this study was found to be 29% of which 20.7% were known DM cases and 8.3% were newly diagnosed. On analyzing the risk factors of diabetes in TB patients, about 14% of the TB patients had a family history of diabetes. About two-thirds of males use tobacco in the form of cigarettes; i.e., smoking about 14.8 cigarettes in

a day. The average duration of smoking among smokers is 15.1 ± 12.9 years. Similarly, two-thirds of males consume alcohol with an average daily consumption of 295 ± 75.9 ml per day. Majority of the TB patients were underweight with a mean weight of 46.8 ± 11.4 kg [28].

CONCLUSION

CBNAAT (Cartridge Based Nucleic Acid Amplification Test) also known as Gene Xpert MTB/RIF assay is a novel integrated diagnostic device for the diagnosis of tuberculosis and rapid detection of RIF's resistance in clinical specimens. As India is a high TB burden country this can help in appropriate treatment decision on the same day. The test has been strongly recommended by WHO (October 2013) as initial diagnostic test in pulmonary and extrapulmonary (CSF, conditional for lymph node and other tissues) tuberculosis.

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