Original Research Article

Epidemiological surveillance of tuberculosis among HIV/AIDS seropositive individuals attending ART center at a tertiary care teaching hospital

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ABSTRACT

Background: HIV/ AIDS is an epidemic that is most prevalent in India affecting people of different age groups, occupations and gender. It has a severe impact on the health status of the affected individuals. With the increase in the transmission of HIV there is also an increase in the existence of TB as a co-infection. In this context, the aim of our study is to emphasize the factors affecting the occurrence, transmission and prognosis of HIV/AIDS patients along with TB co-infection.
Methods: A cross sectional study was conducted from October 2015 to March 2016 at an ART center in South India. All the seropositive patients with/ without opportunistic infection above the age of 18 years were included in the study.
Results: Overall 374 patients were included in the study, of which the most affected age group was 18-45 years. Women constituted 55.61% of the total population. 64.17% of the individuals were married. Majority of them belonged to rural areas (64.97%) and were illiterates (37.43%). Commonly observed WHO clinical stage was I and functional status was working. Heterosexuality (93.65%) was the predominant route of transmission. 170 had TB with PTB (60.58%) being prevalent than EPTB (33.52%). The number of smear positive and smear negative cases were 37.79% and 27.55% respectively. DOTS therapy was accessible to only 49.99%.
Conclusions: There was an extensive prevalence of TB among HIV/AIDS individuals. This signifies a need for increased screening of TB among HIV seropositive individuals and vice-versa. Preventive and educational programmes should be organised to halt the transmission of HIV and to reduce the newly occurring HIV infections.

Keywords: Prevalence, Routes of transmission, ART regimen, Types of TB, Smear characterization, CD4 counts

INTRODUCTION

Human immunodeficiency virus (HIV) infection is a pandemic that is spreading at a rapid pace influencing the social and economic perspectives of the affected individuals. About 36.9 people globally were living with HIV and about 2 million people were newly infected with HIV. It is estimated that 15.8 million people were accessing antiretroviral therapy (ART) by June 2015 which was increased when compared to 13.6 million in June 2014. Approximately 1.2 million deaths due to AIDS related illness were estimated worldwide. Among

the infected individuals worldwide 41% of adults, 32% of children and 73% of pregnant women living were accessing treatment by the end of 2014.[1]

In Indian scenario, Adult (15-49) HIV prevalence was estimated at 0.26% of which prevalence in males constituted at 0.30% and females at 0.22%. Among the states Andhra Pradesh (AP) and Telangana had a prevalence of 0.66% ranking fourth preceded by Manipur, Mizoram, and Nagaland.[2]

In India, people living with HIV and acquired immunodeficiency syndrome (AIDS) (PLHA) were estimated to be about 21.17 lakhs with highest estimated numbers living in undivided AP and Telangana i.e., 3.95 lakhs. About 75.9 thousand new infections were estimated to have occurred in adults in 2015. AP and Telangana combinely contribute to 7.5 thousand of new infections. The occurrence of new infections declined by 50% and AIDS related deaths declined by 60 – 70% in AP and Telangana. However, the ART programme should be updated to meet the needs of 13.45 lakh PLHIV of which more need can be observed in AP and Telangana.[2]

Though the occurrence of new infections and AIDS related deaths have decreased, reduction in new HIV infections remain to be the greater concern and challenge. This also stresses on the need for effective preventive strategies and identification of high risk population through efficient screening procedures.[2]

The pattern of change in epidemiologic trends all over the country is based on the change in exposure and risks faced at community level. So, the trends and patterns in the epidemic should be studied thoroughly by obtaining and analysing data from programme monitoring, surveillance, evaluations and research.[2]

Various risk factors have been found to be associated with HIV/AIDS transmission such as multiple number of sexual partners, sex with sex workers, being in sex work, receptive anal sex, inconsistent condom use and genital ulcer disease. Younger men exposed to behaviours like early initiation of sex, premarital sex, and bisexual orientation have been found as potential targets for HIV. These behaviours were found to be associated with poor educational background stressing on the need for preventive educational interventions and strategies in high risk population.[3]

Whereas women who were married and monogamous contracted the disease from their partners. This necessitates the need for effective improvement in sexual communication. Perinatal HIV transmissions leading to paediatric HIV infections can be prevented by administering Zidovudine.[3]

Transmission through parenteral route can be eliminated through measures like reducing availability of drugs and de-addiction programmes, education for safe injecting practices and providing clean needles.[3]

HIV/AIDS has a significant economic impact on the affected individuals as majority of them belong to the low socio economic groups majorly residing in rural areas. The impact is severe as it mainly affects the working age group. It was found that unemployment was increased in affected individuals after being tested positive which imposes economic burden on the families.[4]

The functional status reflects the ability of the affected individuals to perform daily activity. The functional status has a positive correlation with the disease status and CD_4 cell counts, which worsens with the progression of the disease and in the presence of opportunistic infections.[6]

Thus the entire socio – demographic profile depicts the clear picture of the age group, risks associated with disease occurrence, transmission and socio economic impact specific to geographical area which will be very much useful in designing effective control programmes and interventions.

METHODS

Study duration

The study was conducted for a period of 6 months from November 2015 to April 2016.

Study site

The study was performed at antiretroviral therapy center of Sri Venkateshwara Ramnaraian Ruia Government General Hospital, Tirupathi, and a 1000 bedded tertiary care teaching hospital.

Study design

Cross sectional study

Sample size

Sample size was found to be 374 based on the formula given by Jaykaran et al., for calculating the sample size for a cross sectional study.[6]

Inclusion criteria

All the HIV positive patients attending the ART centre above the age of 18 years, with or without a history of opportunistic infections were included in the study.

Exclusion criteria

Exclusion criteria were the patients who were not willing to participate in the study; the patients who take ART/

ATT at private hospitals; patients in whom the data regarding diagnosis and duration of therapy was not clearly available.

Prior to initiation of the study permission was obtained from the medical officer of the regional ARTC. The data was collected in predesigned profile form containing details of the patients such as age, gender, residential address, occupation, educational status, religion, WHO clinical stage, functional status, and baseline CD4 counts from the patient case records. Patients were selected randomly during the period of data collection. The information related to the patients was maintained confidentially without revealing their identity.

Data analysis

The data was entered in Microsoft excel sheet for analysis and depiction of the data in the forms of graphs.

RESULTS

A total of 374 patients were included in the study, though all the parameters required were noted from the medical records some missing variables were not recorded and were represented as unavailable in the results section. The results were categorised into socio-demographic and clinical profile, represented in the tables below.

Table 1: Summary of socio-demographic parameters.

S.NO	Socio-demographic parameters	No. of patients (n=374)		Percentage (%)	
	Age groups (in years)	Males	Females	Males	Females
1	18 - 45	132	185	44.38%	55.61%
	46 - 65	32	22		
	>65	2	1		
2	**Marital status**				
	Divorced	21		5.61	
	Married	240		64.17	
	Single	14		3.74	
	Widow/widower	93		24.86	
	Status Unknown	6		1.6	
3	**Educational status**				
	Illiterates	140		37.43	
	Primary school	57		15.24	
	Secondary school	136		36.36	
	College and above	41		10.96	
4	**Occupation**				
	Agriculture	28		7.48	
	Business	27		7.21	
	Driver	24		6.41	
	Government employee	8		2.13	
	Home maker	95		25.4	
	No occupation	21		5.61	
	Non skilled labour	152		40.64	
	Private employee	18		4.81	
	Student	1		0.26	
5	**Social habits**				
	Past smoker & alcoholic	64		66.66	
	Past alcoholic & current smoker	1		1.04	
	Past alcoholic	9		9.37	
	Past smoker	2		2.08	
	Current alcoholic	8		8.33	
	Current smoker	5		5.2	
	Tobacco chewing/ Betel nut	1		1.04	
	Individuals with no social habits were 284 of 374				
6	**Religion**				
	Hindu	359		95.98	
	Muslim	15		4.01	

7	**Residence**		
	Rural	243	64.97
	Urban	132	35.02
8	**Modes of transmission**		
	Blood transfusion	2	0.8
	Heterosexual	351	93.85
	Men having sex with men	1	0.26
	Other heterosexual routes	12	3.2
	Sex worker	1	0.26
	Unknown	3	0.8
	Unsafe injection	4	1.06

Table 2: Summary of clinical parameters.

S.NO	Clinical parameters	No. of patients (n=374)	Percentage (%)
1	**WHO clinical stage**		
	I	293	78.34
	II	17	4.54
	III	34	9.09
	IV	18	4.81
	Status unknown	12	3.2
2	**Functional status**		
	Ambulatory	30	8.02
	Bedridden	2	0.53
	Working	320	85.56
	Status unknown	22	5.83
3	**Adherence (%)**		
	51 – 60	3	0.8
	61 – 70	1	0.26
	71 – 80	1	0.26
	81 – 90	28	7.48
	91 – 100	341	91.17
	Avg. Adherence	-	90.12%
4	**ART regimen at initiation**		
	AZT + 3TC+ ATV/RTV	1	4.81
	SLE	36	0.26
	SLN	63	9.62
	TLE	75	16.84
	TLN	13	20.05
	ZLE	42	3.47
	ZLN	126	11.22
	Unknown	18	33.68
6	**Opportunistic infections**		
	Cystitis	1	0.26
	Dermatitis	2	0.53
	Eczema	1	0.26
	Herpes zoster	3	0.8
	Impetigo	1	0.26
	Papular eruptions	1	0.26
	Pelvic Inflammatory Disease	1	0.26
	Pruritic papular erythema	1	0.26
	Tuberculosis	170	45.45
7	**Type of TB**	**n=170**	
	Pulmonary	103	60.58
	Extrapulmonary TB	57	33.52
	Relapse	10	5.88

8	**Sites of EPTB**	**n = 57**	
	Abdomen	11	19.29
	Abdomen + Axillary lymph node	1	1.75
	Cold abscess	2	3.5
	Hip joint	1	1.75
	Lymphadenopathy	14	24.56
	Meningitis	4	7.01
	Miliary TB	1	1.75
	Pleural effusion	11	19.29
	Spine	3	5.26
	Unknown	9	15.78
9	**Smear characterization***	**n = 127**	
	Smear positive	48	37.79
	Smear negative	35	27.55
	Status unknown	44	34.64
10	**Types of diagnostic modalities**	**n = 170**	
	Biopsy	2	1.17
	Biopsy + Chest X ray	3	1.76
	Chest X ray	4	2.35
	FNAC	1	0.58
	Sputum test	14	8.23
	Sputum test + Chest X ray	112	65.88
	Sputum test + FNAC	1	0.58
	Unknown	33	19.41

*Sputum test was performed in 127 individuals out of 170 individuals diagnosed with TB.

Table 3: CD4 counts of HIV/AIDS seropositive patients.

CD4 counts (Cells/mm^3)	No. of patients		
	At HIV diagnosis (n = 374)	ART initiation (n = 374)	TB diagnosis (n = 170)
<50	33	35	20
<200	129	155	58
200 – 500	141	157	61
500 – 1200	45	12	15
>1200	0	0	0
Unavailable	26	15	16
Mean (cells/mm^3)	247.22	199.65	218.31

Clinical profile

Clinical profile of the patients includes WHO clinical staging, functional status, adherence, CD4 counts, body weight, TB diagnostic methods, smear characterization, types of extrapulmonary TB (EPTB), and DOTS therapy. Of these WHO staging, functional status and body weight correspond to the values at HIV diagnosis (Table 2).

Apart from the above mentioned parameters, DOTS therapy was accessible to only 49.99% of the HIV TB co-infected individuals.

DISCUSSION

Socio-demographic profile and factors influencing HIV prognosis

According to the age wise distribution, 89.30% of the individuals belonged to the age group of 18 – 45 years similar to the findings reported by Sintayehu et al., and Shamim et al.[7,8] The mean age of the study population was found to be about 36.67 years (SD ±10.02) which is comparable to the findings made by Singh et al., Shamim et al., Sintayehu et al., and Duru et al.[7-10]

The majorly affected age group represented the sexually active population with increased chance of transmission of HIV.[10] Thus the increase in the prevalence in this age group contributed to a major burden on the socio economic status of the country.[11] The common contributing factors for the occurrence of HIV in this age group were as follows

- Low antiretroviral coverage
- Presenting at late stages
- Societal inhibitions
- Regional/ cultural beliefs
- Poor health systems
- Lack of nutrition

- Low socio-economic status[10]

In the study population, female patients were affected more constituting 55.61% when compared to males 44.38%, these finding were in acceptance with the studies performed by Sintayehu et al., Duru et al., Alemayehu et al., who reported 63.7%, 67.1%, and 64.2% of female population in their studies respectively.[7,10,12] This scenario was due to a variation in biological factor making females more liable to HIV infection.[12] The impact of random sampling might also have been the reason for increase in the number of female patients in the study.

With regard to the marital status, majority of the study population was married i.e., 60.42% which was comparable with the studies performed by Babu et al., Duru et al., Singh AP et al., and Ghiya et al.[9,10,13,14] Increase in married individuals suggests that the possible mode of transmission might be from their partners.

About 24.6% of the study population were widowed/widowers. This finding was quite contrast with those reported by Babu et al., and Singh et al.[9,13] The reason behind this scenario was that females acquire HIV from their male counterpart lately and in the meantime the males were expected to die earlier due progression of disease. The widowed female population were at increased risk for HIV infection as they end up in exchanging sexual activity for emotional and financial support.[9]

About 3.74% were single which was not comparable to the study performed by Babu et al.[13] About 5.61% of the study population were divorced which was not in correlation with the results stated by Alemayehu et al.[12]

In this study, 37.43% of the patients had no education and 15.24% had primary education, similar to the outcomes found by Alemayehu et al.[12] The increase in illiteracy and lack of higher education can be considered as one of the contributing factors for increased prevalence of HIV. It can also be reflected scenario for the occurrence of other opportunistic infections.[10] Lower education status on a whole and also lack of awareness regarding safe sex were also related with increased prevalence of HIV.[8]

In the current study 40.64% of the occupations were unskilled labourers, 7.48% agriculturists, 4.81% were employees, analogous to the findings of Babu et al.[13] The occupations associated with increased mobility such as unskilled labourers are at risk of HIV transmission despite of the gender variations. Usually the occupations associated with transportation had higher risk of HIV transmission.[13] Nearly 25.40% of the population constituted of home makers which was comparable to the study performed by Singh et al.[9]

The remaining less commonly found occupations were students (0.25%), which was consistent with the findings

made by Shamim et al.[8] It was testified that low socio-economic status plays a major role in social behaviour of the individuals prompting the incidence and transmission of HIV infection. Also low socio-economic status has a negative impact on adherence of the therapy.[9]

The substance abuse observed in our study was 25.66% which was comparatively less when compared to the study done by Refera et al.[15] The individuals habituated to alcohol, tobacco and other drugs are at higher risk of undergoing unprotective sex, and exposing themselves to HIV infection.[16] In those individuals who were already diagnosed positive substance abuse causes a negative impact on the adherence of the drug therapy and also fastens the disease progression.[17]

The major portion of the affected individuals was Hindu's (98.98%). In the study performed by Shamim et al., majority of the population belonged to Hindu's (71.9%) though the percentage was less compared to our study.[8]

About 64.97% of the population were from rural regions and 35.29% were from urban areas. The findings in our study were supported by Shamim et al.[8] The major scenario behind this finding is, frequent relocation and immigration of the rural population to urban areas with respect to occupational concerns resulting in an increased exposure.

The most commonly observed route of transmission was heterosexual route comprising of 93.85% of the study population, 0.80% blood transfusions and 1.06% unsafe injection which were related to the reports by Suresh Babu et al.,[13] Similar findings related to routes of transmission were reported by Singh et al, and Shamim et al.[8,9]

The major reason behind predominance in heterosexuality was gaining infection from the HIV positive partners.[8] The majority of infected individuals through heterosexual route were females. This is majorly because women were usually given very little freedom in decision making like condom use with their partners and also due to economic dependence on partners.[9] These findings also suggest that appropriate screening, educational interventions and screening programs were needed to prevent the impact of heterosexuality on disease transmission.[13]

Clinical profile influencing HIV prognosis

The majority of study population 78.34% were in WHO stage I followed by stage II, III and IV. Increased study population presenting in WHO I and II to the ART center at the time of diagnosis was considered as positive outcome of efficient referral from the Involuntary Counselling and Testing Center (ICTC).[8] It was also found that WHO clinical stages III and IV were

considered as one of the risk factors of mortality among HIV – TB co-infected individuals.[15]

The mean body weight of the study population was found to be 46.59 Kg (SD±14.33) at the time of diagnosis which was consistent with the finding of Dinakar et al and Vaneet et al.[18,19] It was identified that body weight was independent of CD4 count, and it acts as an index to change in the rate of viral replication and also shows a significant decline in the presence of severe opportunistic infections and HIV related malignant diseases.[18]

The significant loss of weight is associated with the following factors.

- Poor prognosis
- More rapid disease progression
- Disability
- Increased mortality.[19]

In this study majority of the study population was in working status, comparatively very few people experienced ambulatory and bedridden status. The similar findings were observed in the study conducted by Refera et al., and Thejus et al.[4,15]

The studies performed revealed that functional status of the affected individuals at the time of diagnosis was known to have a positive correlation with disease stage and negative correlation with CD4 count.[15] One of the risk factors that shortened the Quality of Life (QoL) of HIV/ AIDS patients was the presence of bedridden functional status. Ambulatory and bedridden functional status were the components that had an impact on the survival of the HIV – TB co-infected individuals.[15]

About 37.70% of the sample population were in stage III followed by 34.49% in stage II. The mean CD4 count in males was 226.35 cells/mm^3 and in females was 264 cells/mm3 respectively which was comparable with the mean CD4 counts mentioned in Singh AP et al.[9]

Low CD4 counts in males might be due to late reporting to the ART centres with rapid disease progression and presence of other opportunistic infections at the time of diagnosis. The higher CD4 counts in female when compared to men was due to late contraction of the infection by females.[9] It was proved that CD4 counts <200 cells/mm^3 act as risk factor for the development of opportunistic infections.[7,10]

The most commonly prescribed regimen was ZLN in our study which was in compliance with the studies performed by Babu et al, Dinakar et al and Chitra K et al.[13,18,20] The regimens containing stavudine were not used due to the potential adverse effects caused. The regimens containing protease inhibitors were reserved for those people who do not gain remarked CD4 elevations and reduction in viral load with I line regimens.

The efficacy of TLE/N and ZLE/N regimens was similar but the safety profile of TLE/N regimens were much better.[20] The use of Tenofovir and Emtricitabine as the first line drugs was considered in the setting with adequate revenue.[19] So, Tenofovir containing regimens were considered for ART initiation recently compared to Zidovudine based regimens.

The average adherence in the study population was 91.17% which was more when compared to the adherence reported by Nivedita et al.[21] Lack of adherence is one of the major contributing factor for lost to follow up (LFU), the reasons for this were:

- Stigma related to HIV and AIDS
- HIV testing in multiple set ups
- Lack of social support for continuation of treatment
- Prioritizing societal concerns rather than continuing therapy.[19]

The most commonly observed opportunistic infections in our study were TB, herpes zoster, oral candidiasis, PPE, and dermatitis. Devoid of TB the other opportunistic infections were similar to those reported by Babu et al, and Dabla et al.[13,22]

The prevalence of TB in our study was found to be 45.45%, similar prevalence of TB were reported by Surendra et al whereas in few studies conducted by Davood et al, Takalkar et al, the prevalence varied.[23-25]

The prevalence rates may vary from one study to other as the screening for TB in HIV patients was less. The factors effecting change in prevalence were as follows

- Gender
- Educational status
- Residence
- Occupational status
- Marital status
- CD4 count level
- WHO clinical stage of the HIV

About 60.58% people of the study population had PTB and 33.52% had EPTB which was in contrast to the findings made by Magna et al., and Ghiya et al.[14,26] In our study males were more affected when compared to females which was comparable with the study conducted by Maori et al., and Singh et al.[9,27] The major reason behind this was high social interaction in males making them susceptible to opportunistic infections.[9]

In our study 10 out of 170 patients had relapse of TB accounting to about 5.88%, this parameter was comparable with the study conducted by Picon et al.[28] The main cause for relapse might be related to either exogenous reactivation or endogenous reinfection which cannot be distinguished from each other.

Smear positive cases were slightly more than smear negative, this finding was in accordance to that reported by Davood et al, and Sintayehu et al.[7,24] Usually TB – HIV infection is a progressive stage characterized by paucibacillary state in the sputum, making the diagnosis through smear studies very difficult. So, additional evaluations should be made through pathologic examination of the specimens using biopsy.[24]

The most commonly observed EPTB site was pleural effusion and lymphadenopathy which was similar with the study performed by Magna et al.[26] The most commonly observed symptoms were fever, cough and loss of weight which was similar to the symptomatic profile identified by Davood et al and Magna et al.[24,26].

Of the affected individuals only 49.99% patients were accessible to DOTS therapy which was quite contrast to the findings made by Kamath et al.[29] So, there is a need to develop the accessibility to DOTS therapy in order to enhance the follow up and also to prevent relapses.

CONCLUSION

In the present scenario, we have observed that younger and productive age groups, female gender, illiterates and rural people constituted the majority of the study population. Heterosexuality was seen in main stream in the study population. Also the mean CD4 counts at the time of diagnosis were less indicating progressive disease states. TB was found to be one of the most prevalent OIs with characteristic smear negativity. TB relapse was also seen manifesting as either PTB/EPTB.

Keeping this in view there is a need to lay emphasis on effective preventive and management strategies even to remote corners of the country with respect to both HIV and HIV – TB co-infection. Also there is a necessity to employ effective diagnostic techniques other than sputum test such as IGRA, GeneXpert, and culture tests to improve reporting of smear negative cases. In addition, escalating public awareness on HIV TB co-infection and on recognition of early TB symptoms is very important especially to those who are already HIV seropositive. Effective rehabilitation programmes should be encouraged to prevent high risk individuals with substance abuse from restraining sexual exploitation.

Though the occurrence of AIDS related deaths have decreased, reduction in new HIV infections remain to be the greater concern and challenge. This also stresses on the need for identification of high risk population and educating them properly to promote the health, lessen drug resistance problem and finally prolong life.

The pattern of change in epidemiologic trends all over the country is based on the change in exposure and risks faced at community level. So, the trends and patterns of the epidemic should be studied thoroughly by obtaining and analysing data from programme monitoring,

surveillance, evaluations and research. So, the present study represents the epidemiologic and clinical profile of the patients attending the ART center at Tirupathi.

So, as the saying goes Prevention is always better than cure. It would be of utmost importance to concentrate on prevention rather than running behind effective solutions for cure.

REFERENCES

1. MDG 6: 15 years, 15 lessons of hope from the AIDS response. 2015 global statistics:1-4. Available at: http://slideflix.net/doc/3455058/-2--how-aids-changed-everything--mdg-6--15-years--15-less. Accessed on 3 March 2017.
2. India HIV estimations 2015 – Technical report. National AIDS Control Organisation & National Institute of Medical Statistics, ICMR. Ministry of Health & Family Welfare, Government of India. Available at: http://indiahivinfo.naco.gov.in/naco/resource/india-hiv-estimations-2015-technical-report. Accessed on 3 March 2017
3. Sheela G, Sanjay M. HIV/AIDS epidemic in India: risk factors, risk behaviour & strategies for prevention & control. Indian J Med Res. 2005;121:356-68.
4. Basantha KP, Ramamani S, Shalabh KS. Socio-Economic Impact of HIV and AIDS in India. National AIDS Control Organisation. Ministry of Health and Family Welfare. Government of India; 2006.
5. Thejus TJ, Jeeja MC, Jayakrishnan T. The Functional Status of Patients with AIDS Attending Antiretroviral Treatment Center. Indian J Palliat Care. 2009;15(1):57-60.
6. Jaykaran C, Tamoghna B. How to Calculate Sample Size for Different Study Designs in Medical Research? Indian J Psychol Med. 2013;35(2):121–6.
7. Sintayehu F, Wondu T, Getnet A. Prevalence and determinants of Tuberculosis among HIV infected patients in south Ethiopia. J Infect Dev Ctries. 2015;9(8):898-904.
8. Shamim H, Vijay K, Shashi BS, Shalini S. A Study on Socio-demographic Profile and CD4 Count of HIV Infected Patients Attending ART Centre RIMS, Ranchi. Healthline J. 2015;6(1):12-17.
9. Singh AP, Singh S, Alawa HL. Socio-clinical profile of HIV patients visiting to an ART centre. SAARC J Tuber Lung Dis HIV/AIDS. 2013;2:7-14.
10. Duru CB, Uwakwe KA, Diwe KC, Nnebue CC, Chineke HN, Emerole CA. Prevalence of Active Pulmonary Tuberculosis among HIV Positive Patients Attending Adult HIV Clinic In A Teaching Hospital In Imo State, South East, Nigeria: A 6 Year

Review (2006-2012). Indian J Med Res Pharm Sci. 2014;1(6):10-20.

11. Olaniran O, Hassan REO, Oyovwevotu MA, Agunlejika RA. Prevalence of Tuberculosis among HIV/AIDS Patients in Obafemi Awolowo University Teaching Hospital Complex Oauthc, ILE –IFE. Int J Biol Med Res. 2011;2(4):874 -7.

12. Alemayehu B, Zelalem A, Yibeltal B, Bisratewongel T, Gebeyaw T, Amsalu F. Magnitude and correlates of tuberculosis among HIV patients at Felege Hiwot Referral Hospital, Bahir Dar city, northwest Ethiopia. Clin Med Res. 2013;2(4):77-83.

13. Suresh BK, Ram BCh, Baratha JN, Sunita K. A study on socio-demographic profile and status of HIV/AIDS patients under antiretroviral therapy (ART) visiting VCTC at MGM hospital, Warangal, Andhra Pradesh, India. Int J Basic Applied Med Sci. 2014;4(3):135-45.

14. Ragini G, Eknath N, Beata C, Ricardo I, Yogesh M. Clinico-epidemiological profile of HIV/TB coinfected patients in Vadodara, Gujarat. Indian J Sex Transm Dis AIDS. 2009;30(1):10-5.

15. Hailu R, Eshetu W. Survival of HIV-TB co-infected adult patients under ART in Ambo Referral Hospital, Ethiopia. Ethiop. J. Health Dev. 2013;27(2):88-93.

16. Shadrack AY, Michael FO, Rekha RS, Sarah SN. Human Immunodeficiency Virus and Immunological Profiles among Suspected Tuberculosis Cases in Mombasa County, Kenya. J Tuberculosis Res. 2016;4:34-45.

17. United States. National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. Division of HIV/AIDS Prevention. HIV and Substance Use in the United States. CDC;2013. Available at: https://www.cdc.gov/hiv/pdf/risk/cdc-hiv-idu-fact-sheet.pdf. Accessed on 3 March 2017.

18. Dinakar KR, Narendranath S, Vaneet A, Reshma SR, Somashekar HS, Keerthisagar J. Changes in the CD4 counts, hemoglobin and weight in patients with HIV alone and HIV – TB co-infection. Asian J Pharm Clin Res. 2014;7(2):35-8.

19. Vaneet A, Reshma SR, Somashekar HS. Evaluation of the effects of the anti-retroviral drug regimens (zidovudine + lamivudine + nevirapine) on CD4 count, body weight, and Hb% of the HIV patients-a retrospective study. Int J Interdisciplinary Multidisciplinary Studies. 2015;2(5):177-85.

20. Krishnan CR, Sajeeth CI. A comparative study of antiretroviral therapy induced CD4 T-cell changes among HIV infected patients. Int Res J Pharm. 2014;5(9):726-9.

21. Nivedita M, Shreeniwas R, Rupal M, Amit A, Nagappa P. Long term outcome of adult patients on antiretroviral (ART) in India. MOJ Immunol. 2015;2(4):1-7.

22. Vandana D, Anil KG, Ishwar S. Spectrum of opportunistic infections among HIV seropositive patients in Delhi region-a study by Delhi state AIDS control society. J Medical Disorders. 2015;3(1):1-5.

23. Surendra KS, Manish S, Prasad KT, Sanjay R. Clinical profile & predictors of poor outcome of adult HIV-tuberculosis patients in a tertiary care centre in north India. Indian J Med Res. 2014;139:154-60.

24. Davood M, Kamyar A, Arash A. Prevalence of Clinical Tuberculosis in HIV Infected Patients from Kermanshah Province, IRAN. Tanaffos. 2002;1(2):27-33.

25. Anant AT, Saiprasad GS, Prasad VG, Narendra SM. Study of Opportunistic Infections In HIV Seropositive Patients Admitted to Community Care centre (CCC), KIMS Narketpally. Biomed Res. 2008;23(1):139-42.

26. Magna M, Sitikantha N. Prevalence of HIV infection among tuberculosis patients in Eastern India. J Infect Public Health. 2013;6:358-62.

27. Lynn M. Prevalence of Tuberculosis among HIV/AIDS Patients Attending Zambuk General Hospital. New York Sci J. 2012;5(5):33-6.

28. Pedro DP, Sergio LB, Maria LAC, Roberto LTF, Carla AJ, Patrícia RBV. Risk factors for recurrence of tuberculosis. J Bras Pneumol. 2007;33(5):572-8.

29. Ramachandra K, Vikram S, Sanjay P, Mohandas BH, Varalakshmi C. HIV–TB coinfection: Clinico-epidemiological determinants at an antiretroviral therapy center in Southern India. Lung India. 2013;30(4):302-6.