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Prevalence of Tuberculosis Co-infection and Associated Factors Among HIV Patients Attending Anti-Retroviral Therapy at Jimma University Specialized Teaching Hospital, South West Ethiopia

Kelemuwa Desalegn Shiferaw Bekele Fekadu Yadassa
Department of Nursing, College of Health Sciences, Jimma University, Jimma, Ethiopia

Sub-title: Tuberculosis and HIV co-infection

Abstract

Back ground: Tuberculosis (TB) is the leading cause of death among HIV infected patients. About one third of HIV infected patients are co-infected with TB and most of them are living in low and middle income countries. HIV is the most powerful risk factor known for activation of latent mycobacterium tuberculosis (MBT) infection.

Objective: To determine the prevalence of TB co-infection and associated factors among HIV patients attending anti-retroviral therapy (ART).

***Method*:** An institution based cross-sectional study was conducted at ART clinic of Jimma University Specialized teaching Hospital (JUSTH) from March to April 2016. A convenient sampling technique was used to collect data from each study participant. Data were collected by trained data collectors. An interview based structured questionnaire was used to collect data. Statistical analysis was performed using Microsoft office excels for window 2008 and SPSS version 20. Bi-variate and multi-variate logistic regressions were done to assess the relationship between dependent and independent variables. P value less than 0.05 was considered as statistically significant.

***Results*:** From 321 totals study participants, 197(61.4%) were females. The mean age plus standard deviation (SD) was 36.08±10.2 ranging from 12-72 years and 208 (87.5%) were urban dwellers .The prevalence of TB and HIV co-infection was 94(29.3 %). Being greater or equal to 45 years old (AOR=2.4, 95%CI : 0.193 , 2.898); having CD4 count less than 200cells/mm^3 (AOR=2.8, 95%CI: 0.165, 0.165 , 3.769); not taking ART regularly (AOR=2.6, 95%CI: 1.006, 5.621); having history of cigarette smoking (AOR=5.9, 95%CI: 0.045 , 6.645) and having history of alcohol drinking (AOR=2.8, 95%CI: 0.220 , 3.591) were the determinant factors associated with TB infection in HIV patients .

***Conclusion*:** There was high prevalence of TB infection among HIV patients in the study area. High age groups, having CD4 count less than 200cells/mm^3, not taking ART regularly, having history of cigarette smoking and alcohol drinking were associated with HIV and TB co-infection. Thus, health information about risk factors for TB infection and early diagnosis and treatment of TB infection are very important for HIV patients in the study area.

Keywords: HIV-TB co-infection, risk factors, Jimma

1. Back ground

Tuberculosis (TB) is the leading cause of death among HIV infected patients. TB and HIV have a shared immune compromising effects mechanism due to this TB causes mortality among HIV infected patients [1]. About one third of HIV infected patients are co-infected with TB and most of them are living in low and middle income countries [2] and HIV triggers the development of active TB by promoting the progression of infections with mycobacterium tuberculosis (MBT) to active TB both in people with recently acquired TB infections and those with latent TB infections. HIV is the most powerful risk factor known for activation of latent MBT infection. For an HIV infected person, the risk of developing active TB reaches 5-10% annually [2, 3].

HIV also has an influence on transmission of TB by increasing the number of TB patients which in turn increases TB transmission from family members, through house hold contacts such as children and HIV positive partners and from community through contact in work places, school and hospital where there is a risk of nosocomial infections from both patients (whether HIV-positive or -negative) and health care workers. Additionally, the risk of multidrug resistant TB (MDR-TB) also increases if effective and uninterrupted TB treatment is not ensured [1, 2].

HIV influences the clinical presentation of TB by declining the immune system. CD4 lymphocytes decline by about 50–80 cells/mm3/year as HIV infection progresses and the immune system becomes less able to prevent the growth and local spread of MTB [1, 3]. In the early stage of HIV infection (CD4> 350 cells/mm^3), the clinical presentation of TB cases is similar to that of individuals without HIV infection. But the clinical presentation in late HIV cases (CD4 <200 cells/ mm^3), exhibits itself differently. In case of severe immunodeficiency, the rate of extra pulmonary TB (EPTB) increases in both adults and children [3, 4].

TB has been found directly responsible for an average mortality rate of 30% among HIV/AIDS cases in

many reports. These data emphasize the need of early diagnosis and specific treatment of TB in all HIV-infected patients, especially when the clinical pattern of CD4 cells count shows a severe degree of immunodeficiency [5].

All HIV-positive people should be assessed for risk factors for having or acquiring TB since HIV-positive people are at higher risk for having or developing active TB which is one of the major opportunistic infections causing death in people living with HIV (PLWH) [1, 2, 3].

2. Methods

A study was conducted at anti-retroviral therapy (ART) clinic of Jimma University Specialized Teaching Hospital (JUSTH) from March to April 20016. JUSTH is located in Jimma Town within Jimma Zone of Oromia Regional State. An institution based cross-sectional study design was used. All patients attending ART clinic at JUSTH were source population. A total of 321 HIV patients who have been active for their routine follow-up at ART clinic of JUSTH during study period, willing to participate and provided consent were included in this study. And those, HIV patients who had mental problem and unable to give consent and seriously ill were excluded from the study.

Socio-demographic data such as age, sex, educational status, residence, etc and clinical related data such as history of smoking, history of alcohol drinking, CD4 status, etc of each study participants were collected by using interview based questionnaire. Before collecting data from each study participant, training was given for data collectors (nurses working in ART clinic). After that each question developed on the questionnaire was made clear for each participant by data collectors under the supervision of principal investigator. Then, the participants were given chance to ask question for unclear things if there, and the data collectors were responded for their questions under the supervision of principal investigator. Finally, the data were collected from each study participant by interviewing them using the developed questionnaire

Statistical analysis was performed using Microsoft office excels for window 2008 and SPSS version 20. Bi-variate and multi-variate analysis was done to assess how well predicator independent variables explain or predict dependent variable and to control possible confounders and to identify the determinant factors associated with TB and HIV co-infection. P value less than 0.05 was considered as statistically significant, but for the sake of multi-variate analysis P value less than 0.25 was considered. All data from questionnaires were checked manually for completeness and clarity as well as edited for inconsistencies before data analysis.

3. Results

3.1. Socio-demographic characteristics of the study participants

A total of 321 study participants were included in the study. Majority, 197(61.4%) were females and the rests males. The mean age and standard deviation of the study participants were 36.08±10.2 SD ranging from 12-72 years and 118(36.8%) was between age group of 35-44 years. Two hundred eighty one (87.5%) were urban dwellers and majority, 208(64.8) were married. Majority of the study participants, 172(53.6) were orthodox in religion and 128(39.9) were Oromo. One hundred twenty–eight (39.9%) had Primary level education and 115(35.8%) government employees [table 1].

3.2. Clinical related characteristics of study participants

Duration since HIV was diagnosed in majority of study participants, 185(57.6%) between 5-10 years and 173(53.9%) had started taking ART between 2-5 years and 289(90.0%) had been taking ART on regular basis. Two hundred nine (65.1%) had CD4 count greater than 250 cells/mm^3 [table-2]

Eight independent variables whose P value less than 0.25 at bi-variate analysis were entered to multi-variate analysis model. After multi-varite analysis was done, the three independent variables were removed since they had no significant association with the dependent variable [table 1 and 2].

The prevalence of TB among study participants was 94(29.3 %) and twelve (3.7%), 39(12.1%), 138(43.0%) of the study participants had history of TB infection in the family, history of cigarette smoking and alcohol drinking respectively. In multivariate logistic regression analysis, being older than 45 years was 2.4 times more likely to develop TB than the other age groups(AOR=2.4,95%CI: 0.193,2.898, P value =0.03) [table-1) and those who had CD4 cell count less than 200 cells/mm^3 were 2.8 times (AOR= 2.8, 95%CI: 0.165, 3.769, P value =0.009) more likely to develop TB than those who had CD4 count greater than 250 cells/mm^3 and those who had been taking ART regularly were about 2.6 times (AOR=2.6, 95%CI:1.006, 5.621, P value=0.04) more likely to develop TB than those who had been taking ART regularly. Those study participants who had history of cigarette smoking were 5.9 times (AOR=5.9, 95%CI: 0.133, 6.645, P value =0.000) more likely to develop TB than those who had no history of cigarette smoking and those who had history of alcohol drinking were 2.8 times (AOR=2.8, 95%CI: 0.220, 3.591, P value= 0.004) more likely to develop TB than those who had no history of alcohol drinking [table 2].

Table -1: Socio-demographic characteristics of HIV patients attending ART clinic at JUSTH, Jimma town, Jimma zone, South West Ethiopia, 2016, (n=321).

Variable	Variable category	Number (%)	COR (95 % CI)	P Value	AOR(95 % CI)	P Value
Sex	Male	124(38.6)	0.79 (0.486,1.294)	0.35	0.49 (0.586,1.94)	0.46
	Female	197(61.4)	1		1	
Age	≤24	27(8.4)	1		1	
	25-34	115(35.8)	0.95(0.317,0.283)	0.92	0.95(0.28,3.24)	0.94
	35-44	118(36.8)	0.80(0.382,1.689)	0.56	0.73(0.33,1.62)	0.43
	≥45	61(1.9)	0.42(0.207,0.867)	0.019*	2.4(0.211,0.95)	0.03
Place of residence	Urban	281(87.5)	1.03(0.98,1.03)	0.76	1.03(0.78,1.32)	0.92
	Rural	40(12.5)	1		1	
Marital status	Single	61(19.0)	1		1	
	Married	208(64.8)	0.92(0.291,2.96)	0.9	0.42(0.491,2.86)	0.91
	Divorced	33(10.3)	0.90(0.311,2.62)	0.85	0.80(0.33,2.52)	0.75
	widowed	19(5.9)	0.549(0.159,1.893)	0.43	0.49(0.179,1.893)	0.53
Occupation	G. employee	115(35.8)	1		1	
	Private	48(15.0)	0.39(0.081,1.87)	0.24*	0.4(0.07,2.29)	0.3
	NGO	16(5.0)	0.60(0.12,3.13)	0.545	0.7(0.12,4.17)	0.69
	Farmer	18(5.6)	1.4(0.668,11.68)	0.756	1.4(0.14,14.97)	0.69
	Daily laborer	66(20.6)	0.7(0.107,4.59)	0.71	0.96(0.12,7.38)	0.97
	House wife	48(14.3)	0.43(0.086,2.13)	0.301	0.59(0.11,3.22)	0.55
	Student	12(3.7)	0.46(0.088,2.36)	0.35	0.68(0.12,3.96)	0.85
Education status	Primary level(1-8)	128(39.9)	0.65(0.362,1.19)	0.17*	0.56(0.24,1.27)	0.16
	High school (9-10)	70(21.8)	0.78(0.388,1.56)	0.48	0.64(0.28,1.46)	0.28
	Preparatory (11-12)	31(9.7)	1.14(0.435,3.00)	0.79	0.86(0.29,2.49)	0.78
	College & above	92(28.7)	1		1	

Abbreviations: COR=crude odd ratio, CI= confidence interval, Hx=history; * variable with P value<0.25

Table-2: Clinical characteristics of HIV patients attending ART clinic at JUSTH, Jimma town, Jimma zone, South West Ethiopia, 2016, (n=321).

Variable	Variable category	Number (%)	COR (95 % CI)	P Value	AOR(95 % CI)	P Value
Duration of diagnosis for HIV	<5 years	89(7.7)	1		1	
	5-10 years	185(57.6)	0.45(0.185,1.08)	0.07*	0.50(0.172,1.47)	0.21
	≥11 years	47(14.6)	0.48(0.197,1.02)	0.056	0.45(0.18,1.14)	0.09
ART beginning time	≤1 year	40(12.5)	0.64(0.298,1.379)	0.26	0.44(0.393,1.39)	0.12
	2-5 years	173(53.9)	0.97(0.57,1.66)	0.92	0.57(0.57,1.66)	0.32
	>5 years	108(33.6)	1		1	
CD4 count status	<200 cells/mm^3	42(13.1)	0.39(0.197,0.775)	0.007*	2.8(0.165,3.769)	0.009
	200-250 cells/mm^3	70(21.8)	0.62(0.344,1.11)	0.108*	0.56(0.294,1.065)	0.077
	>250cells/mm^3	209(65.1%)	1		1	
Taking ART regularly	Yes	289(90.0)	1		1	
	No	32(10.0)	1.76(0.829,3.722)	0.117*	2.6(1.006,5.621)	0.04
TB history in the family	Yes	12(3.7)	0.19(0.057,0.657)	0.008*	0.21(0.089,1.25)	0.23
	No	309(96.3)	1		1	
Hx of cigarette smoking	Yes	39(12.1)	0.27(0.133,0.527)	0.000*	5.9 (0.045, 6.645)	0.008
	No	282(87.9)	1		1	
Hx of alcohol drinking	Yes	138(43.0)	0.36(0.220,0.591)	0.000*	2.8(0.220,3.591)	0.004
	No	183(57.0)	1		1	

Abbreviations: COR=crude odd ratio, CI= confidence interval, Hx=history, AOR=adjusted odd ratio; * Variable with P value<0.25

According table 1 and 2 above, variables with P value less than 0.25 in bi-variate analysis were entered into multi-variate logistic regression model

4. Discussion

Over all the prevalence of TB and HIV co-infection in the study area (29.3%) was comparable to the finding reported from Nepal (32.4%) (13), but less than the finding reported from Kenya (41.8%) (16) and Nigeria (44.2%) (17). Compared to the finding reported from South Sudan (9.0%) (20), the prevalence of HIV and TB co-infection in current study area was much higher.

When compared to the study done in different areas in Ethiopia, the finding was comparable to the finding reported from Addis Ababa (10.1%) (23), but a little higher than the finding reported from Butajira(20.3%), Sothern Ethiopia and much higher than the finding reported from Arbaminch (6.8%) .This

difference in prevalence of TB and HIV co-infection might be due to the difference in prevalence of HIV infection in these various study areas and early diagnosis and treatment of HIV patients for TB infection.

Unlike the finding reported from Nigeria (P value<0.05) (17) gender has no significant association with the co-infection of TB and HIV. Having age greater or equal to 45 years, having CD4 cell count less than 200cells/mm^3, not taking ART regularly, having history of cigarette smoking and alcohol drinking were factors associated with TB infection in HIV patients. According to the current finding, HIV patients who had CD4 cell count greater than 200cells/mm^3 had no significant association with TB infection. Educational status, monthly income, length of diagnosis for HIV ,duration ART beginning , being urban or rural , being married , single or divorced and the presence of TB history in the family had no significant association with TB infection (P value >0.05).

Being greater or equal to 45 years old was 2.4 times more likely to develop TB when compared to those with less age group. The possible reason may be in addition to HIV infection that cause immune deficiencies , increasing in age may have indirect relationship with immune status .HIV patients with CD4 cell count less than 200 cells/mm^3 were 2.8 times more likely to develop TB when compared to those with higher CD4 cell count. This can be explained in terms of the fact that less CD4 cell count is associated with immune suppression that causes HIV patients Vulnerable to opportunistic infections. Study participants not taking ART at regular basis were found 2.6 times more likely to be infected with TB when compared to those who had not been taking ART regularly. The possible explanation for this might be taking ART may enhance the immune status of the HIV patients so that less exposure to opportunistic infections. Having history of alcohol drinking and cigarette smoking had also significant association with TB infection for HIV patients. This might be explained there in terms of the effects of cigarette smoking and alcohol drinking and on immune status of HIV patients.

5. Conclusion

There was high prevalence of TB infection among HIV patients in the study area. Age greater or equal to 45 years, less CD4 cell count, not taking ART regularly, having history of cigarette smoking and alcohol drinking were the determinant factors associated with TB infection among HIV patients . Health information about risk factors for TB infection and early diagnosis and treatment of TB infection are very important for HIV patients in the study area.

6. Lists of abbreviation

AOR=Adjusted odd ratio
ART: Anti-retroviral therapy
CD4: Cluster of differentiation 4
COR=Crude odd ratio
EPTB: Extra pulmonary tuberculosis
HIV: Human immunodeficiency virus
JUSTH: Jimma University specialized teaching Hospital
MBT: Mycobacterium tuberculosis
MDR: Multi-drug resistant
PLWH: People living with HIV
PTB: Pulmonary tuberculosis
TB: Tuberculosis
WHO: World Health Organization

7. Declaration

7.1. Ethical consideration

Letter of ethical clearance was taken from Jimma University to JUSTH authorities. Before actual data collection, the purpose of the study was explained for each study participants. The data collected from each study participant were used only for the purpose of this study. Verbal consent was obtained from each study participants and the study participants had full right to withdraw from the study at any time.

7.2. Availability of data and materials

All data generated or analyzed are included in this article .

7.3. Competing interest / Conflict of interest

The author(s) have no competing interests for financial support, publication of this research, patents and royalties through this collaborative research. All authors were equally involved in discussed research work. There is no financial conflict with the subject matter discussed in the manuscript

7.4. Authors contribution

Kelemuwa Desalegn, Shiferaw Bekele and Fekadu Yadassa were involved in conception and design, and acquisition of data. Kelemuwa Desalegn took the lead in data generation, analysis and drafting the manuscript. Shiferaw Bekele and Fekadu Yadassa revised the draft manuscript critically for important intellectual content. All authors were involved in analysis and interpretation of the data, as well as final approval of the version to be published

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