Original Article

Tuberculosis and HIV Co-infection and associated factors among HIV reactive patients in Ethiopia

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Abstract

Context: The most common opportunistic infection among Human Immunodeficiency Virus (HIV) reactive patients is tuberculosis (TB). TB has an impact on the prognosis of the disease. However, developing countries have not paid much attention to the problem.

Aims: The study was conducted with the aim of determining the level of TB/HIV co-infection and associated factors.

Setting and Design: A cross sectional study design was used in Wolaita Sodo Teaching and Referral Hospital from March 15 to May 15, 2017.

Materials and Methods: Three hundred and seventy three patients were selected using simple random sampling.

Statistical Analysis Used: Frequencies and proportions were computed. Logistic regressions were carried out and associations were considered statistically significant at $P < 0.05$.

Results: The study revealed that 17.4% of the patients were co-infected with HIV and TB. Educational status (adjusted odds ratio [AOR] =0.472 and 95% confidence interval [CI] =0.253, 0.883), drug dependency (AOR = 2.366 and 95% CI = 1.129, 4.957), World Health Organization stage (AOR = 3.031 and 95% CI = 1.326, 6.930), and baseline CD4 (AOR = 0.351 and 95% CI = 0.153, 0.803) were predictors of the TB/HIV co-infection.

Conclusion: Educational status, drug dependency, WHO clinical stage, and baseline CD4 count were found as significant predictors of co-infection. Therefore, health education about the lifestyle modification, counseling, and close monitoring of pharmacological therapy adherence is recommended.

Keywords: Acquired immunodeficiency syndrome, Co-infection, Tuberculosis

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INTRODUCTION

Tuberculosis (TB) is the leading cause of morbidity among human immunodeficiency virus (HIV)-reactive patients. In 2017, 0.9 million people were TB/HIV coinfected. TB contributes to the death of 0.3 million people who are infected with Acquired Immune Deficiency Syndrome (AIDS).[1]

In Ethiopia, AIDS incidence is high. The contributing factors are economic hardship, expanding urbanization, labor migration, and the opening of new trade sectors.[2,3]

The most common opportunistic infection among reactive patients is TB. It occurs at any stage of AIDS. Most of

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the time, it is recognized as the early manifestation of undetected AIDS case.[4-7] One-third of patients infected with HIV-acquired TB. Those patients are at higher risk of death.[8,9]

HIV/AIDS pandemic has caused a resurgence of TB, resulting in increased morbidity and mortality worldwide. HIV and *Mycobacterium tuberculosis* have a synergistic interaction; each accentuates progression of the other. Coinfection with HIV and TB is a medical, social, and economic problem.[10]

HIV-seropositive patients are twenty times more likely to develop coinfection when compared to HIV-seronegative patients.[11] Coinfection is a serious global threat, particularly for people living in developing countries, especially for women and adolescents.[12]

HIV enhances the prognosis of infection with TB. Furthermore, TB causes the worsening of opportunistic infections.[13-15] This is a great challenge for the treatment of patients.[16]

Immunodeficiency is expressed by the blocking of immune surveillance mechanisms and thus by the establishment of favorable condition to the development of opportunistic infections' malignancy. Immunodeficiency also contributes to the TB infection. *M. tuberculosis* transmission may occur in any setup within the health institutions.[17]

TB diagnosis needs performing extensive laboratory investigations in combination with the clinical judgments.[18-22] TB has an impact on HIV replication. This worsens the patient clinical condition.[23,24] However, developing countries have not paid much attention to the problem. In the study area, there is no previous research addressing coinfection. Therefore, this research was conducted with the aim of determining the level of TB/HIV coinfection and associated factors.

MATERIALS AND METHODS

Health facility-based cross-sectional study design was conducted in Wolaita Sodo University Teaching and Referral Hospital (WSUTRH). WSUTRH provides service for 2 million people coming from Wolaita, Dawuro, Goffa, and Kembata Tembaro zones. The hospital has an antiretroviral therapy (ART) clinic. In 2017, 2495 patients were on ART. The study was conducted from March 15 to May 15, 2017.

The source population was all patients with HIV/AIDS attending ART clinic at WSUTRH, and the study population was sampled patients attending ART clinic during the data collection period who fulfilled the inclusion criteria. HIV/AIDS patients whose age is at least 18 years were included in the study.

The sample size was determined using a single population proportion by assuming that 33% TB-HIV coinfection with 95% confidence interval and 5% margin of error. Adding a 10% nonresponse rate, the sample size was 373. Simple random sampling technique was used. The samples were selected from the list of individuals who have an appointment during the study period. The medical record number was used as an identifier, and computer-generated random sampling method was used.

A structured questionnaire was adapted after a review of literature.[10,15,19] It has 23 questions. The questionnaire sought information on sociodemographic characteristics, patients' characteristics, knowledge about HIV transmission, TB presentation, and clinical and immunological characteristics. Response for the TB presentation included the two categories: (1) Yes and (2) No. Patient medical record review and face-to-face interview were conducted.

After checking data completeness, it was coded and entered into EpiData version 3.1, The EpiData Association, Odense, Denmark. The data were cleaned by visualizing, calculating frequencies, and sorting. The data were analyzed using SPSS version 20 statistical software , SPSS (Hong Kong) Ltd, Westlands Road, Quarry Bay, Hong Kong. Frequencies and proportions were computed. Associations were determined using odds ratios with 95% confidence interval. Bivariate and multiple logistic regressions employed considering $P < 0.05$ as a statistically significant association. Finally, the results were presented in the form of tables, figures, and sentences.

A pretest was done. In addition, the completeness and consistency of the questionnaire were examined each day during data collection.

Ethical clearance letter was obtained from the Institutional Review Board of Nursing Department in Wolaita Sodo University, College of Health Science (NSG/058/2017). In addition, informed verbal consent was obtained from each respondent after providing sufficient information. The consent was verbal because the personal identity was protected, and the participants were uncomfortable in signing as they taught that they might be identified. Therefore, it was easy to build a trust with the study participants.

To ensure the confidentiality, the name of respondents was not written on the questionnaires.

RESULTS

All the respondents were involved in the study obtaining the response rate of 100%. The result revealed that 231 (61.9%) were female. Majority (35.4%) of the participants were in the age group of 25–34 years [Table 1]. Regarding the patient behaviors, 275 (73.7%) participants were drug dependent. Three hundred and forty-one (91.4%) eat a meal three times per day, and 277 (74.3%) had good appetite [Table 2].

For the majority (45.6%), the source of information was health professionals. Two hundred and eighty-five (76.4%) participants know HIV/AIDS transmission through sexual intercourse [Table 3].

Concerning partner status, the partner of 164 (89.1%) respondents knows their status, of which 158 (96.3%) were reactive. The majority (64.3%) were in the WHO Stage 1 and 259 (69.4%) started using ART before 6 months [Table 4].

Regarding the TB/HIV coinfection, 65 (17.4%) HIV-reactive patients were coinfected with TB. The majority (97.9%) were using TB prophylaxis [Table 5].

Educational status, drug dependency, WHO stage, and baseline CD4 count were found as significant predictors of coinfection ($P < 0.05$) [Table 6].

DISCUSSION

In the study, the prevalence of HIV-TB coinfection was 17.4%. This might be related to the inappropriate use of the prophylaxis. It implies that the need for interventions decreases the existence of the coinfection. The finding is lower than the finding of a retrospective study conducted in Ethiopia (27.7%),[25] a study done in Northeastern Ethiopia (24.3%),[26] a study did western Kenya (41.8%),[27] and a study done in Nigeria (32.8%).[28] However, the findings of this study were higher compared to other studies conducted in Ethiopia (7.5%),[29] Nigeria (13.9%),[30] India (0.13%),[31] and Pakistan (4.39%).[32] The difference might be related to the difference in the treatment adherence of patients in the studies areas. Second, it might be related to the difference in the sociodemographic characteristics of the study participants. Third, the difference in the quality of health service delivered by various health professionals might contribute to the difference.

Table 1: Sociodemographic characteristics among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo

Variables	*n* (%)
Sex	
Male	142 (38.1)
Female	231 (61.9)
Age	
18-24	90 (24.1)
25-34	132 (35.4)
35-44	85 (22.8)
45 and above	66 (17.7)
Ethnicity	
Wolaita	321 (86.1)
Goffa	24 (6.4)
Amhara	10 (2.7)
Siltie	4 (1.1)
Others	14 (3.8)
Religion	
Protestant	270 (72.4)
Orthodox	68 (18.2)
Muslim	9 (2.4)
Catholic	9 (2.4)
Others	17 (4.6)
Marital status	
Single	137 (36.7)
Married	184 (49.3)
Divorced	24 (6.4)
Widowed	28 (7.5)
Educational status	
Illiterate	88 (23.6)
Educated	285 (76.4)
Occupation	
Employed	284 (76.1)
Unemployed	14 (3.8)
Pensioner	21 (5.6)
Student	54 (14.5)
Residence	
Urban	252 (67.6)
Rural	121 (32.4)

Table 2: Patients' characteristics among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo

Variables	*n* (%)
Drug dependency	
Yes	98 (26.3)
No	275 (73.7)
BMI (kg/cm^2)	
<18.5	94 (25.2)
18.5-24.99	212 (56.8)
25-30	43 (11.5)
>30	24 (6.4)
Baseline CD4 (cells/mm^3)	
<200	55 (14.7)
200-350	145 (38.9)
>350	173 (46.4)

BMI: Body mass index

Those patients with a CD4 count >350 cells/mm^3 were 64.9% less likely to develop coinfection as compared to those with a CD4 count <200 cells/mm^3. This finding is supported by a study conducted in Ethiopia.[25] This might be due to the decreased protective effect of the immunologic

Table 3: Knowledge about human immunodeficiency virus transmission ways among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Swodo

Variables	*n* (%)
Source of information about HIV/AIDS	
Health professional	170 (45.6)
Mass media	169 (45.3)
Friends	26 (7)
Others	8 (2.1)
Sexual intercourse transmission	
Yes	285 (76.4)
No	88 (23.6)
Sharp materials sharing transmit HIV/AIDS	
Yes	68 (18.2)
No	305 (81.8)
Mother to child transmission	
Yes	346 (92.8)
No	27 (7.2)
Need to use condom by PLWHA	
Yes	361 (96.8)
No	12 (3.2)

HIV: Human immunodeficiency virus, AIDS: Acquired immune deficiency syndrome, PLWHA: People living with HIV/AIDS

Table 4: Clinical and Immunologic characteristics among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo

Variables	*n* (%)
Partner know status (*n*=184)	
Yes	164 (89.1)
No	20 (10.9)
Partner status (*n*=164)	
Different	158 (96.3)
Similar	6 (3.7)
WHO clinical stage	
One	240 (64.3)
Two	57 (15.3)
Three	43 (11.5)
Four	33 (8.8)
Period at which ART started	
<6 months	114 (30.6)
6 months and above	259 (69.4)

ART: Antiretroviral therapy, WHO: World Health Organization

Table 5: Tuberculosis presentation among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo

Variables	*n* (%)
TB coinfection	
Yes	65 (17.4)
No	308 (82.6)
Investigation type	
Sputum	333 (89.3)
X-ray	32 (8.6)
Expert	8 (2.1)
TB prophylaxis	
Yes	365 (97.9)
No	8 (2.1)

TB: Tuberculosis

cells. When the immune systems compromised, an opportunistic infection may occur. Immunosuppression may allow reactivation of *M. tuberculosis*.

Drug dependency is also one factor influencing the coinfection status. Accordingly, those HIV-reactive patients who were drug dependent were 2.4 times more likely to develop coinfection as compared to those who were not. The finding from studies conducted in West African countries and Ethiopia supports this finding.[25,33,34] Those patients who are drug dependent might have a low appetite causing low immunological protection against different infections including TB, and they might engage in risky life behaviors that increase susceptibility. The use of drugs might change the perception of those individuals and forced to engage in behaviors that further diminish the immunological status causing TB.

Regarding the WHO stage, those who were in Stage 3 were 3.03 times more likely to develop coinfection as compared to those who were in the WHO Stage 1. This finding is supported by other studies conducted in Pakistan[32] and Ethiopia.[34] According to the WHO staging of HIV/AIDS, those HIV-reactive patients in Stage 3 are more likely to develop TB. Furthermore, an atypical pulmonary presentation is common in more advanced HIV disease.

Educated HIV-reactive patients were 52.85% less likely to develop coinfection as compared to those who were illiterate. This is similar to a report from a study done in India[31] and Ethiopia.[25] This might be related to the lower quality of life among those who were illiterate associated with exposure to various means of information transmission. It might also relate to the health-seeking behavior of educated people.

The study limitation is that the finding from this study mainly reflects the situation in WSUTRH. Therefore, the findings should be interpreted with caution.

CONCLUSION

Majority of the patients were in the WHO Stage 1. The main type of TB was pulmonary TB and most of them were taking TB prophylaxis. Educational status, drug dependency, WHO clinical stage, and baseline CD4 count were found as significant predictors of coinfection. Health education about the lifestyle modification, counseling, and close monitoring of pharmacological therapy adherence is recommended.

Conflicts of interest

There are no conflicts of interest.

Author contribution

All authors contributed to this research.

Table 6: Factors associated with human immunodeficiency virus-tuberculosis coinfection among reactive patients attending antiretroviral therapy clinic at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo

Variables	Coinfection		COR (95% CI)	AOR (95% CI)
	Yes	No		
Marital status				
Single	25	112	1	1
Married	34	150	1.015 (0.573-1.798)	1.046 (0.567-1.927)
Divorced	4	20	0.896 (0.282-2.852)	0.730 (0.209-2.558)
Widowed	2	26	0.345 (0.077-1.548)	0.253 (0.054-1.195)
Educational status				
Illiterate	24	64	1	1
Educated	41	244	0.448 (0.252-0.796)*	0.472 (0.253-0.883)*
Drug dependency				
No	12	86	1	1
Yes	53	222	1.711 (0.872-3.358)	2.366 (1.129-4.957)*
WHO stage				
One	34	206	1	1
Two	12	45	1.616 (0.776-3.362)	1.640 (0.751-3.580)
Three	14	29	2.925 (1.404-6.093)*	3.031 (1.326-6.930)*
Four	5	28	1.082 (0.391-2.996)	1.157 (0.396-3.382)
BMI (kg/cm^2)				
<18.5	16	78	1	1
18.5-24.99	37	175	1.031 (0.541-1.963)	0.972 (0.491-1.923)
25-30	3	40	0.366 (0.101-1.329)	0.448 (0.119-1.688)
>30	9	15	2.925 (1.091-7.841)*	2.559 (0.857-7.645)
Baseline CD4 (cells/mm^3)				
<200	13	42	1	1
200-350	32	113	0.915 (0.438-1.909)	0.920 (0.422-2.002)
>350	20	153	0.422 (0.194-0.919)*	0.351 (0.153-0.803)*

*Significant association at $P<0.05$. WHO: World Health Organization, BMI: Body mass index, CI: Confidence interval, COR: Crude odds ratio, AOR: Adjusted odds ratio

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