Tobacco and alcohol: The relation to pulmonary tuberculosis in household contacts

N Gyawali,[1] R Gurung,[2] N Poudyal,[2] R Amatya,[1] R Shrestha,[2] LK Khanal,[1] S Timilsina[1] and SK Bhattacharya[2]

[1]Department of Microbiology, Nepal Medical College, Jorpati, Nepal, Jorpati, Kathmandu, Nepal; [2]Department of Microbiology, BP Koirala Institute of Health Sciences, Dharan, Nepal

Corresponding author: Mr. Narayan Gyawali, Department of Microbiology, Nepal Medical College, Jorpati, Kathmandu, Nepal; e-mail: gyawali123@gmail.com

ABSTRACT

Tuberculosis is transmitted commonly by droplet nuclei and facilitated by weak immune system. Lowered immunity may be associated with cigarette smoking, tobacco chewing and alcohol consumption. The co-relationship between these all factors to TB should be explored. This study aims to detect the hidden household contacts (HC) cases early and to examine the relative contribution of tobacco and alcohol use to the risk of TB. A cross-sectional study was in Dharan among HCs. From June 2009 to May 2010, 184 index cases with sputum smear positive for AFB and their 802 HCs were included. Three sputum specimens were collected from each HCs and examined microscopically for AFB detection. AFB were detected in sputum of 13 (1.6%) HCs. The association between habits (alcohol user and smoking) and TB was found except with chewing tobacco user ($P>0.05$). The risk of contact TB was 4 and 8 times greater in smoker (OR= 3.94 95%CI= 1.26-12.26, $P<0.05$) and alcoholic (OR=8.23 95%CI= 2.71- 24.98, $P<0.05$) HCs respectively. This study has revealed smoking and alcohols as the risk factors for tuberculosis. Effective campaign to discourage use of alcohol and tobacco, and awareness programme about the mode of transmission of TB are needed in community.

Keywords: Tuberculosis, alcohol, tobacco.

INTRODUCTION

Tuberculosis (TB) is a respiratory tract infection caused by *Mycobacterium tuberculosis*. Large mortality and morbidity of this disease has been reported every year.[1] One gets TB infection most commonly by droplet nuclei, which are aerosolized while coughing, sneezing and speaking by an infected person. The tiny droplets dry rapidly; the smallest (<5–10 μm in diameter) may remain suspended in the air for several hours and may reach the terminal air passages when inhaled. There may be as many as 3000 infectious nuclei per cough.[2] A house becomes suitable environment for holding these droplets nuclei, favouring for contact TB. Individuals may develop disease soon after they become infected, others may get sick later when their immune system becomes weak. Lowered immunity may be associated with health-deteriorating factors, such as cigarette smoking, tobacco chewing and alcohol consumption.[3] Many studies have shown that tobacco and alcohol use increases the rates of TB infection both in terms of incidence and severity.[4-7]

Although, the independent relation of household contacts, tobacco and alcohol to TB has been known for long time, the co-relationship between these all factors to TB is less discussed. The objective of present study is to detect the hidden household contacts (HC) cases early and to examine the relative contribution of tobacco and alcohol use to the risk of TB. The explored relation could be an important key for making new policy to control TB.

MATERIALS AND METHODS

During the period of one year (June-2009 to May-2010), a cross-sectional study was carried out in Dharan Municipality, Nepal to determine the prevalence of Pulmonary TB in HCs and to determine the risk of tobacco use and alcohol consumption for development of PTB. All AFB positive cases diagnosed by sputum smear microscopy at tuberculosis laboratory, B P Koirala Institute of Health Sciences (BPKIHS); a referral centre of Eastern Nepal, were included in this study as Index Cases (ICs). Family members of ICs, who were above 5 years of age and living under the same roof and sharing the same kitchen with ICs were taken as HCs. On the basis of local prevalence of PTB (4.7%) calculated from previous hospital records of BPKIHS and taking 15% allowance error in 95% of conidence interval (CI), calculated sample size for HCs was 800. The study was ethically approved by the ethical committee of BPKIHS. A total of 184 ICs and their 802 HCs were included in the study. A short questionnaire containing socio-demographic variables: age, gender, residence, occupation,

educational status and behavioral information: habit of smoking, chewing tobacco using and alcoholic was filled up after asking to participants. Finally, participants were properly instructed to collect three sputum specimens in provided standard wide mouthed sputum containers.

Three early morning sputum smaples were collected over 3 days. All collected samples were transported to the laboratory. A total number of 2406 (802 x 3) sputum specimens were processed for staining with fluorescent technique using Auramine-O for screening, and confirmed by Ziehl-Neelsen (Z-N) method. At least 100 microscopic oil immersion fields in microscope were examined to declare a slide negative. Grading system recommended by International Union against Tuberculosis and Lungs Diseases (IUATLD)[8] was considered for the quantification of bacilli. The AFB positive contacts were referred to the Department of Medicine for the treatment.

The collected data were entered in the excel data entry software. To assess association between all categorical risk factors and AFB positivity, univariate analysis was performed using χ^2test. Odds ratio and their 95% confidence intervals (CI) were also calculated. For the purpose of analysis SPSS 16.0 version software was used.

RESULTS

During the study period, 184 ICs and their 802 HCs were studied. The median household size was 5.0. AFB were detected in sputum of 13 (1.6%) HCs. The median age of HCs was 29; 59.1% were females. Frequency of demographic variables of household contacts shown in Table 1. The table 2 shows the analysis of behavioral variables with sputum smear results. The association between habits (alcohol user and smoking) and TB was found except with chewing tobacco user (P>0.05). The risk of contact TB was 4 and 8 times greater in smoker (OR= 3.94 95%CI= 1.26-12.26, P<0.05) and alcoholic (OR=8.23 95%CI= 2.71- 24.98, P<0.05) HCs respectively.

DISCUSSION

Tuberculosis is a major public health problem of the world. It is estimated that about one-third of the world population is infected with TB. According to the WHO report (2009) more than 1.7 million deaths is due to TB only.[1] The major mode of transmission is droplet nuclei resulted from infected persons while coughing, sneezing or speaking. House is a perfect model which creates favorable environment for the transmission of infected droplets nuclei. The concept of present study was to detect the hidden HC cases and relative contribution of tobacco and alcohol to the risk of TB among HCs.

Table-1: Demographic data and result of sputum smear

Variables	Categories		Frequency N (%)	AFB Positive N (per 1000)
Age	5-14yrs (Children)		151(18.8)	1(6.6)
	15-59yrs (Working group)		547(68.2)	9(16.5)
	>60yrs (Retired group)		104(13.0)	3(28.8)
Sex	Male		328(40.9)	7(21.3)
	Female		474(59.1)	6(12.7)
Status	Single (Unmarried, widows and married but not with spouse)		453(56.5)	5(11.0)
	With spouse		349(43.5)	8(22.9)
Religion	Hindu		628(78.3)	10(15.9)
	Other than Hindu	Buddhist	84(10.5)	2(23.8)
		Christian	49(6.1)	0
		Muslim	24(3.0)	1(41.6)
		Others	17(2.1)	0
Education Status	Illiterate		42(5.2)	3(71.4)
	Literate	≤10 grade	570(71.1)	9(15.8)
		>10 grade	190(23.7)	1(5.3)
Occupation	Unemployed	Students	294(36.7)	1(3.4)
		Unemployed other than students	279(34.8)	6(21.5)
	Employed	Professional	104(13)	1(9.6)
		Non-professional non skilled worker	104(13)	5(48.1)
		Non-professional skilled worker	21(2.6)	0

Total HCs= 802, AFB positive= 13

Table-2: Analysis of Behavioral variables with Sputum smears result

Variables	Categories	Positive/total (%)	OR	95% CI	P value
Smoking	Yes	5/113 (4.4)	3.94	1.26-12.26	0.011
	No	8/689 (1.2)			
Alcohol	Yes	7/105 (6.7)	8.23	2.71-24.98	<0.001
	No	6/697 (0.9)			
Chewing Tobacco	Yes	4/113 (3.5)	2.77	0.83-9.16	NS
	No	9/689 (1.3)			

NS= Non Significant

Our study showed 13/802 (1.6%) prevalence of TB among HCs. This result is higher than the prevalence (0.61%) reported in previous study from the Eastern Nepal.[9] This difference can be explained by the differences in the design of the study and timing of the research carried. However, studies based on similar setting from Kenya in 1978, Malawi in 2002 and India in1996 reported similar rate of prevalence; 1.67%, 2.02% and 2.22% respectively.[10-12] But the overall case detection rate again relates poorly with the 3%–14.5% figures quoted in studies of contact tracing.[13-17] The differences can be partly explained by different criteria for selection of contacts, the scope of examinations performed on the contact, epidemiology within study area and the type of TB diagnosed.

In this study, males were found AFB positive in higher number compared to females (21.3 per 1000 males: 12.7 per 1000 females). This finding does not correlate with the study conducted in Turkey which reports 50 per 1000 males and 61 per 1000 females in TB cases among HCs.[18] But this gender differences (Male>female) is reasonably consistent with the patterns found in recent studies in Nepal.[19] Epidemiological findings demonstrate that in most settings, tuberculosis incidence rates are higher for males, at all ages except in childhood. Studies have reported that sex differentials in prevalence rates begin to appear between 10 and 16 years of age, and remain higher among males than females thereafter.[20] The probable reason for this may be the habit of smoking and using alcohol in males which decreases the natural defense of cilliary action in respiratory tract and facilitates the progression of tuberculosis.

The prevalence of contact TB was higher where the contacts in the household were illiterate (71.4 per 1000). Strong relationship between health and education has always been known.[21] Lack of awareness and ignorance regarding TB trans-mission might be the reason behind this finding.

This study reinforced existing knowledge about TB transmission being associated with poor economic status.[8] Mostly, unemployed (12.2 per 1000) and non-professional non skilled workers (48.1 per 1000); mainly labors were AFB positive. Most of the contact cases were working with ICs, as their source of income was common.

This hypothesis of smoke can be accepted for cigarette smokers also. We found greater prevalence of TB among cigarette smoker in our study (44.2 per 1000) than nonsmokers HCs (11.6 per 1000). This finding is concordant with other studies.[7,22,23] Habit like smoking has been considered as risk factors for the development of TB by Basnet *et al*.[24] Smokers using more than 5 cigarettes per day had significantly higher risk of patient delay, and the association seemed to be dependent on "dose" since participants using less smoke had less risk than heavy smokers.[24] A study from New Zealand conducted by Calder *et al* to identify the problem of diagnostic delay also had similar findings.[25]

Chewing tobacco has been recognized as another behavioral risk factor,[22] but, we didn't find any association between TB prevalence and chewing tobacco users (P>0.05). Another behavioral factor; alcohol consumption, was found to be associated with the prevalence of TB (P<0.05). The risk of contact TB among alcoholic HC was 8 times higher than non alcoholic (OR=8.23 95%CI= 2.71- 24.98). The increased risk of active TB among alcoholics can be explained by both increased risk of infection related to specific social mixing patterns associated with alcohol use, as well as influence of alcohol on the immune system and alcohol related conditions.[3] Alcohol has been accepted as risk factors by similar studies done in developed countries like Australia, Canada and USA.[26-28] The reason for risk of active TB in people who drink alcohol is due to both increased risk of infection related to specific social mixing patterns associated with alcohol use, as well as influence on the immune system of alcohol itself and of it's related conditions.[3]

Over the years, HCs TB remains the major public health problems. Early tracing could be effective on limiting TB transmission. If Anti-Tubercular Therapy (ATT) can be started to the identified TB cases, it could definitely

add efforts on TB control, which we have done to our positive HCs. This study has revealed smoking and alcohols as the risk factors for contact tuberculosis. Effective campaign to discourage the use of alcohol and tobacco and, educational programme to aware people about the TB and its mode of transmission are needed to control TB.

REFERENCES

1. World Health Organization: Global Tuberculosis Control: Epidemiology, Strategy, Financing: WHO report 2009.
2. Raviglione MC, O'Brien RJ. Mycobacterial diseases. In: Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL *et al*. editors. Harrison's principle of internal medicine. 17th ed.(1): United State of America: McGraw-Hill; 2008:1006-20.
3. Lonnroth K, Raviglione, M. Global epidemiology of tuberculosis: prospects for control. *Semin Respir Crit Care Med* 2008; 29: 481.
4. Bam DS. A hospital case-control study of behavioural risk factors for adult pulmonary tuberculosis in Thailand. Bankkok: Mahidol University, 1991:36-49.
5. Baskin SE, Gale JL, Nolam CM. Tuberculosis risk factors in adults in King Country, Washington, 1988 through 1990. *Amer J Public Health* 1994; 84: 1750-6.
6. Alcaide J, Altet MN, Plans P *et al*. Cigratte smoking as a factor for tuberculosis in young adult: A case-control study. *Tuberc Lung Dis* 1996; 77: 112-6.
7. Yach D. Partnering for better lung health: improving tobacco and tuberculosis control. *Int'l J Tuberc Lung Dis* 2000; 4: 693-7.
8. Khalilzadeh S, Masjedi H, Hosseini M, Safavi A, Masjedi MR. Transmission of Mycoba cterium tuberculosis to households of tuberculosis patients: A comprehensive contact tracing study. *Arch Iran Med* 2006; 9: 208-12.
9. Wares DF, Akhtar M, Singh S, Luitel H. Is TB contact screening relevant in a developing country setting? Experiences from eastern Nepal, 1996–1998. *Int'l J Tuberc Lung Dis* 2000; 4: 920-4.
10. Aluoch JA, Karuga WK, Nsanzumuhire H *et al*. A second study of the use of community leaders in case-fi nding for pulmonary tuberculosis in Kenya. *Tubercle* 1978; 59: 233-43.
11. Claessens NJM, Gausi FF, Meijnen S, Weismuller MM, Salaniponi FM, Harries AD. High frequency of tuberculosis in households of index TB patients. *Int'l J Tuberc Lung Dis* 2002; 6: 266-9.
12. Narain R, Nair SS, Rao GR, Chandrasekhar P. Distribution of tuberculous infection and disease among households in a rural community. *Bull World Health Organ* 1966; 34: 639-54.
13. Bayona J, Chavez-Pachas AM, Palacios E, Llaro K, Sapag R, Becerra MC. Contact investigations as a means of detection and timely treatment of persons with infectious multidrug-resistant tuberculosis. *Int'l J Tuberc Lung Dis* 2003; 7: S501-9.
14. Teixeira L, Perkins MD, Johnson JL, Keller R, Palaci M, do Valle Dettoni Vet al. Infection and disease among household contacts of patients with multidrug-resistant tuberculosis. *Int'l J Tuberc Lung Dis* 2001; 5: 321-8.
15. Gilpin T P, Hammond M. Active case finding—for the whole community or for tuberculosis only? *S Afr Med J* 1987; 72: 260-2.
16. Klausner JD, Ryder RW, Baende E *et al*. *Mycobacterium tuberculosis* in household contacts of human immunodefi ciency virus type 1-seropositive patients with active pulmonary tuberculosis in Kinshasa, Zaire. *J Infect Dis* 1993; 106-11.
17. Afonja AO, Labode MO, Edet EG. Early yield of pulmonary tuberculosis among household contacts of known cases of open pulmonary tuberculosis in Lagos. *East Afr Med J* 1973; 136-9.
18. Talay F, Kumbetli F. Risk Factors Affecting the Development of Tuberculosis Infection and Disease in Household Contacts of Patients with Pulmonary Tuberculosis. *Turkish Respiratory J* 2008;9(1):34-7.
19. Shrestha L, Jha KK. Gender disparity among TB suspects and new TB patients-a record-based retrospective study in SAARC member states. *SAARC J Tuberc, Lung Dis HIV/ AIDS* 2007; 4: 8-18.
20. World Health Organization. Gender and tuberculosis global tuberculosis control. WHO Report 2003 [online]. 2003 [cited 2010 Jun 01]; Available from: URL: http://www. who.int/ entity/gender/documents/en/TB.factsheet.pdf.
21. Kickbusch IS. Health Literacy: Addressing the health and education divide. *Health Promot Int'l* 2001; 16: 289-97.
22. Ariyothai N, Podhipak A, Akarasewi P, Tornee S, Smithtikarn S, Thongprathum P. Cigarette smoking and its relation to Pulmonary Tuberculosis in adults. *Southeast Asian J Trop Med Public Health* 2004; 35: 219-27.
23. Pio A, Chaulet P. Tuberculosis handbook. Geneva: WHO. WHO/TB/98.253. 1998; 20: 70-3.
24. Basnet R, Hinderaker SG, Enarson D, Malla P, Mørkve O. Delay in the diagnosis of tuberculosis in Nepal. *BMC Public Health* 2009; 9: 236.
25. Calder L, Gao W, Simmons G. Tuberculosis: reasons for diagnostic delay in Auckland. *N Z Med J* 2000; 113: 483-5.
26. Milne RC. Alcoholism and Tuberculosis in Victoria. *Med J Aust* 1970:955-60.
27. Pincock TA. Alcoholism in tuberculosis patients. *Can Med Assoc J* 1964; 91: 851-4.
28. Brudney K, Dobkin J. Resurgent tuberculosis in New York City. Human immunodeficiency virus, homelessness, and the decline of tuberculosis control programs. *Amer Rev Respir Dis* 1991; 144: 745-9.