LUNG CANCER IN RELATION TO SMOKING, INCLUDING RELIGHTING CIGARETTE BUTTS: KATHMANDU VALLEY: "AN UNMATCHED CASE CONTROL STUDY"

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ABSTRACT:

Background: Lung cancer is one of the most common cancer in Nepal causing 14.1%of total death among cancer. Nepal is a developing country with poor socio-economic and human development. The rate of lung cancer patient is in an increasing trend. Tobacco smoking is one of the major risk factors causing 70% lung cancer deaths. The major objective of the study was to find the association of cigarette smoking and relighting of cigarette butts while smoking with the occurrence of lung cancer in Kathmandu valley, Nepal.

Methods: An unmatched case control study was conducted among 207 participants including 108 cases and 99 controls. The study areas were from National Hospital and Cancer Research Centre Pvt. Ltd., Bhaktapur Cancer Hospital and areas nearby the hospitals in Kathmandu. The duration of the study was from April 2017 to July 2017. Administered questionnaire including socio-demographic, smoking habits and secondary exposure to smoke characteristics section was used in the process of data collection. Descriptive statistics was done to summarize general characteristics. Bivariate analysis of factors showed p-value<0.2; and it included in the multivariable logistic regression where parsimonious model with backward regression was used to calculate odds ratios (ORs) with 95% confidence intervals in order to find association of risk factors.

Results: In multivariate regression, cigarette smoking was a strong associated risk factor for occurrence of lung cancer (OR=1.91,95%CI=1.001-3.66), even when adjusted with other 11 factors from the bivariate analysis (OR=2.85,95% CI=1.054-7.68).Whereas relighting of cigarette butts while smoking showed positively strong association with occurrence of lung cancer; when it was unadjusted (OR=4.47,95% CI=2.28-8.78) as well as adjusted for 17 factors from bivariate analysis (OR=37.63,95% CI=7.55-187.46).

Conclusions: Smoking and relighting of cigarette butts were major associated risk factors for occurrence of lung cancer. This calls for strengthening the prevention aspect of tobacco control program to focus on behavioral change for reducing relighting of cigarette butts among the general population and tobacco addiction among the general population in Nepal.

Keywords: Lung cancer; Cigarette smoking; Relighting of cigarette butts; Nepal

DOI: *Received: June 2017; Accepted: July 2017*

INTRODUCTION

Cancer is the leading cause of mortality and morbidity worldwide with 14.1 million new cases of cancer and 8.2 million deaths every year [1]. Two third of global cancer cases and deaths occur in low and middle income countries. Not only cancer harms and kills a patient, it also affects the entire society and the family members causing health issues, wide economic, social and development implications.

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Cite this article as: Rana DRL. Lung cancer in relation to smoking, including relighting cigarette butts: Kathmandu valley: "an unmatched case control study". J Health Res. 2017; 31(Suppl.2): S171-8. DOI:

Although Nepal is a developing country with poor socio-economic and human development. Though, Nepal has actively been a part of attaining SDG among non-communicable diseases, lung cancer still accounts for 17.0% and 14.3% mortality in male and female patients with cancer [2].

Direct consumption of tobacco or exposure to second hand smoke is among the most common factors for causing lung cancer in developing and under developed countries. Cigarette smoking has become one of the main risk factors causing lung cancer. Nearly 80-90% of lung cancer caused by cigarette smoking [3]. Many studies in Nepal show predominance of smoking in male (57.5%) and females (42.5%). Males smoke more frequency and longer in duration than female [4]. However, other studies showed predominance in female (71.6%) comparing to male [5, 6]. The method of relighting has shown the higher chances of lung cancer in smokers than those who do not relight [6]. Other studies have shown that not only relighting causes lung cancer, it also increases the rate of lunch diseases such as chronic bronchitis approximately about 15% [7]. The other factors related to relighting in some studies showed that smokers found mainly in female (unemployed, low income and less education) on number of cigarette smoked per day [8]. There is an increasing trend of smoking in the age above 64 years and decreasing in trend with an increase level of education [5]. Similarly, exposure to second hand smoke (SHS) is equally responsible for causing the lung cancer because it has same concentration of carcinogens [9], especially affecting children, nonsmokers and household women [10]. Studies also suggest that positive association of family history and lung cancer may be due to similar environmental factors such as smoking, secondary exposure to smoking, household exposure to smoke and also inherited genetic susceptibility [11, 12].

Most of the research done focused on the effect of smoking on lung cancer; but the effect of the relighting of cigarette butts on lung cancer has not been investigated in detail in Nepal. This study examines the association between relighting of cigarette butts while smoking with lung cancer in Nepal, where relighting is the most prevalent among poor resources and its improper disposal of cigarette butts.

METHODOLOGY

This unmatched case control study was conducted to ascertain the association between occurrence of lung cancer in relation to smoking habit and relighting of cigarette butts while smoking in Kathmandu Valley, Nepal. This study conducted from April 2017 to July 2017. Cases were selected from 2 hospitals in Kathmandu valley: National Hospital and Cancer Research Centre Pvt. Ltd and Bhaktapur Cancer Hospital. Control group was from those living near the hospital. Unavailability of population with lung cancer restricted the researcher to use the mathematical model for calculation of sample size for which OpenEpi (online open source software, version 3.01) was used [13]. The higher sample size calculated by Fleiss statistical method with continuity correction was considered [14]. The total sample size considered for this study was 207, which included 108 cases and 99 controls. Cases were those diagnosed with lung cancer with or without history of previous malignancy receiving treatment at the hospital who were identified from the hospital registry; and diagnosis was confirmed from the histopathological reports of lung biopsy. Controls were those not suffering from lung cancer and from the same area where the hospital is situated. Both cases and controls were chosen irrespective to their smoking status. The willingness to participate was taken into consideration. Severely ill participants were excluded from both cases and controls. For data collection, a pretested well-planned questionnaire containing 26 questions was used; it included socio-demographic, research specific smoking questions including habits related to smoking and those related to second hand exposure to smoke after consulting doctors and researchers [15]. For making data collection more reliable and efficient, every question was asked by the researcher and two qualified nurses in order to minimize the inappropriate responses. Pilot testing was done on 10 lung cancer patients and 10 controls from the same research area as mentioned above. Cronbach alpha coefficient value was 0.777, showed high level of internal consistency for our scale. MS Excel and SPSS version 16.0 were used to manage and analyze the collected data. Descriptive statistics has been used to summarize the characteristics of participants. The second part concentrated on determining the association between the dependent and independent variables and finding if there is a relationship between smoking of cigarettes and occurrence lung cancer; and whether there is a relationship between relighting of cigarettes butts while smoking and occurrence of lung cancer for which bivariate analysis. Chi-square test,

Table 1 Socio demographic characteristics of cases and controls with bivariate analysis

Variables	Lung cancer (N=108)		Non lung cancer(N=99)		*p*-value	OR	95%CI	
	N	%	N	%			LL	UL
Gender								
Female [ref]	58	53.7	41	41.4	0.095[1]	-		
Male	50	46.3	58	58.6		0.61	0.35	1.06
Age								
Mean ±SD	62 ±12		57 ±14		0.011[2]	1.03	1.01	1.05
Range	57		70					
Religion								
Others [ref]	14	13	13	13.1	0.567[1]	-		
Hindu	94	87	86	87		1.02	0.45	2.28
Marital status								
Married [ref]	103	95.3	95	96	1.00[1]	-		
Others	5	4.7	4	4		1.15	0.30	4.42
Occupation								
Service [ref]	28	25.9	35	35.4	<0.001[1]	-		
Business	16	14.8	34	34.3		0.59	0.27	1.28
Housewife	48	44.4	18	18.2		3.33	1.60	6.95
Unemployed	16	14.8	12	12.1		1.67	0.70	4.09
Ethnicity								
Newar	26	24.1	9	9.1	<0.001[1]	0.88	0.34	2.31
Brahmin	3	2.8	57	57.6		0.02	0.04	0.06
Chettri	33	30.6	19	19.2		0.53	0.23	1.20
Others [ref]	46	42.6	14	14.1		-		
Education level								
Illiterate	62	57.4	35	35.4	0.001[1]	4.13	1.71	10.01
Literate	13	12	24	24.2		1.26	0.45	3.55
Primary/Secondary	24	22.2	19	19.2		2.95	1.10	7.90
Higher level [ref]	9	8.3	21	21.2		-		
Monthly income (Baht)								
<10,000	37	34.3	16	16.2	0.006[1]	3.36	1.51	7.48
10,000-20,000	30	27.8	23	23.2		1.90	0.88	2.09
21,000-30000	19	17.6	28	28.3		0.90	0.45	2.19
>30,000 [ref]	22	20.4	32	32.3		-		

[ref]= reference variable, [1] = Chi-square *p*-value, [2] = Independent t-test *p*-value

Table 2 Characteristics of smoking of cases and control along with bivariate analysis

Variables	Lung cancer (N=88)		Non-lung cancer (N=69)		*p*-value	OR	95%CI for EXP(B)	
	N	%	N	%			LL	UL
Smoke cigarette								
No [ref]	20	18.5	30	30.3	0.048[1]	-		
Yes	88	81.5	69	69.7		1.91	1.00	3.66
Type of cigarette								
Local	84	95.5	54	78.3	0.001[1]	5.83	1.84	18.51
Foreign [ref]	4	4.5	15	21.7				
Relight cigarette butts								
No [ref]	26	29.5	45	65.2	<0.001[1]	-		
Yes	62	70.5	24	34.8		4.47	2.28	8.78
Quit smoking								
No [ref]	5	5.7	25	36.2	<0.001[1]	-		
Yes	83	94.3	44	63.8		9.43	3.38	26.35

Table 2 Characteristics of smoking of cases and control along with bivariate analysis (cont.)

Variables	Lung cancer (N=88)		Non-lung cancer (N=69)		*p*-value	OR	95%CI for EXP(B)	
	N	%	N	%			LL	UL
Average cigarette/day								
<10 [ref]	6	7.3	27	40.9	<0.001[1]	-		
10-20	34	41.5	32	48.5		4.78	1.75	13.10
>20	42	51.2	7	10.6		27	8.20	89
Filter								
No	27	30.7	6	8.7	0.001[1]	4.65	1.79	12.04
Yes [ref]	61	69.3	63	91.3		-		
Total years of smoking								
Mean ±SD	40±15		34±17		0.02[2]	1.03	1.00	1.07
Range	73		82					
Age started cigarette								
Mean ±SD	14±6		21±6		<0.001[2]	0.83	0.77	0.89
Range	43		27					

[ref] = reference variable, [1] = Chi-square *p*-value, [2] = Independent t-test *p*-value

Table 3 Characteristics of secondary exposures of cases and controls with bivariate analysis

Variables	Lung cancer (N=108)		Non-lung Cancer(N=99)		*p*-value	OR	95%CI for EXP(B)	
	N	%	N	%			Lower	Upper
SHS exposure at home								
No [ref]	30	27.8	47	47.5	0.003[1]	-		
Yes	78	72.2	52	52.5		2.35	1.2	4.85
SHS exposure at workplace								
No [ref]	62	57.4	43	43.4	0.031[1]	-		
Yes	46	42.6	56	56.6		0.57	0.39	0.99
Type of fuel								
Clean [ref]	54	50	79	79.8	<0.001[1]	-		
Unclean	54	50	20	20.2		3.95	2.13	7.33
Location of cooking								
In The house	104	96.3	84	84.8	0.004[1]	4.643	1.49	14.51
Elsewhere [ref]	4	3.7	15	15.2		-		
Family H/O CANCER								
No [ref]	69	63.9	96	97	<0.001[1]	-		
Yes	39	36.1	3	3		18.09	5.37	60.92

[ref] = reference variable, [1] =Chi-square *p*-value, [2]=Independent t-test *p*-value

independent t-test and multivariate logistic regression model were used to calculate *p*-value, odds ratios (ORs) and 95% confident intervals. Those variables with a *p*-value<0.2 in the bivariate analysis was considered for multivariable logistic regression in which parsimonious model with backward regression was done. The dependent variable in this study is lung cancer and the independent variables are socio-demographic characteristic questions such as age, sex, occupation, smoking history and habits while smoking and secondhand exposure to smoke. The ethical approval was taken from Nepal Health Research Council, Kathmandu, Nepal (Reg. no.83/2017) and written consent was taken from each participant.

RESULTS

In conducting this research, total 207 samples were recruited to the study. 52 % of the respondents were suffering from lung cancer. The mean average age of participants with lung cancer was 62 with SD=12. Most of the cases were females (53.7%), mostly married (95.3%), illiterate (57.4%) and low income of <10000 Baht per month (34.3%), Table 1.

Most of the smokers had lung cancer 81.5%. The smokers used local cigarette (95.5%); and they smoked an average of >20000 cigs/day, Table 2.

Those with lung cancer had more exposure to

Table 4 Association between smoking and occurrence of lung cancer by Multivariate logistic Regression (n=207)

Variables	Lung cancer					
	Unadjusted OR Model 1			Adjusted OR Model 2		
	OR	95%CI		OR	95%C.I	
		Lower	Upper		Lower	Upper
Smoke cigarette (No[ref])	1.91	1.00	3.66	2.85	1.05	7.68
Age of participant				1.03	1.00	1.07
SHS exposure at workplace (No[ref])				0.18	0.08	0.41
Location of cooking in the house (Elsewhere[ref])				9.76	2.30	41.43
Unclean fuel used for cooking				5.35	2.42	11.82
Family H/O cancer (No[ref])				23.72	5.71	98.53
Occupation (Service [ref])						
Business				1.98	0.57	6.87
Housewife				1.52	0.42	5.46
Unemployed				6.99	1.96	24.99

[ref] has been assigned for reference variable

Table 5 Association between relighting of cigarette butt ends and occurrence of lung cancer by multivariate logistic regression (n=157)

Variables	Lung cancer					
	Unadjusted OR Model 1			Adjusted OR Model 2		
	OR	95.0%C.I.		OR	95.0% C.I.	
		Lower	Upper		Lower	Upper
Relight cigarette butts (No [ref])						
Yes	4.47	2.28	8.79	37.69	7.56	187.46
Average cigarette/day						
<10cigs/day [ref]				-		
10-20cigs/day				6.67	1.44	30.93
>20cigs/day				63.72	8.70	466.76
Cigarette filter (Yes [ref]**)**						
No				24.25	3.81	154.53
Age of participant				1.05	0.10	1.11
Occupation (Service [ref]**)**						
Business				0.64	0.12	3.44
Housewife				4.32	0.83	22.41
Unemployed				0.80	0.12	5.26
Family H/O of cancer (No [ref]**)**						
Yes				26.38	2.48	280.38
Location of cooking (Elsewhere [ref])				24.80	3.48	176.82
In the house				-		
SHS exposure at work						
Yes				0.21	0.05	0.81
No [ref]				-		

[ref] has been assigned for reference variable.

second hand smoke at home (72.2%) than at workplace (42.6%); and most of them cooked inside the house (96.3%), Table 3.

Table 4, there is positive association of tobacco smoking and risk of occurrence of lung cancer when not adjusted with other factors (OR=1.91, 95%C.I=1.001-3.66), Model 1 as well as when there is involvement of other factors which may act as confounders (OR=2.85, 95%C.I=1.054-7.68), Model 2. Every increase in age, there is 1.03 times risk of occurrence of lung cancer (OR=1.03, 95%C.I=1.00-1.07).Family history of cancer among immediate family members also showed strong association with occurrence of lung cancer (OR=23.72, 95%C.I=5.75-98.53). Those respondents who cooked inside the house had 9.76 times risk for occurrence of lung cancer (OR=9.76, 95%C.I=2.30-41.43). Other factors such as fuel used for cooking (such as natural gas,

kerosene, coal, wood, animal dung, and charcoal) also showed 3.95 times risk for occurrence of lung cancer. Respondents who were unemployed has 6.99 times risk associated with occurrence with lung cancer (OR=6.99, 95%C.I=1.96-24.99).

Table 5 showed that relighting of cigarette butt while smoking was positively associated with occurrence of lung cancer when it was unadjusted (OR=4.47, 95% CI=2.28-8.78) as well as when OR was adjusted with factors (OR=37.63, 95% CI=7.55-187.46). Those who smoked > 20 cigarettes per/day when adjusted with other factors had 63.716 times positively associated risk (OR=63.72, 95% CI=8.70-466.77) than unadjusted which caused 27 times risk (OR=27, 95% CI=8.19-89) for occurrence of lung cancer. As above, family history of cancer showed positive association with risk of lung cancer (OR=26.38, 95%CI=2.48-280.38) as well as age of the participant (OR=1.05, 95% CI=0.10-1.11). Cooking location inside the house also showed positive association (OR=24.80, 95%CI=3.48-176.82). Here housewives were more at risk possibly because they get more exposed to second hand smoke (OR=4.32, 95%CI=0.83-22.41).

DISCUSSION

Similar to other studies done in the past, our study also shows that females suffered more from lung cancer than males [11, 16, 17]. This is possibly because of high prevalence of smoking among females in Nepal than other developing countries. Specific groups such as Rai, Lama, Sherpa, Magar, etc. suffered more from lung cancer due to low socioeconomic conditions [18]. Level of education also determined the occurrence of lung cancer which it was mostly among the illiterate in our study [18]. Similar to our study, Rimington [19] showed high incidence of lung cancer among smokers. Lung cancer is more common among those who consume local cigarettes (95.5%) and especially among those who smoked unfiltered cigarettes [20, 21]. Those who smoke >20 cigarettes on average/day (51.2%) had more chances of lung cancer; thus increase in cigarettes per day increases the risk of lung cancer [17, 20, 21]. 70.5% of the populations who have relit the cigarette butts end while smoking are suffering from lung cancer as per other studies relighting increases risk of lung cancer [7]. Beside the smoking factor, secondary factors are also equally responsible for causing lung cancer. Study done in Nepal and other countries also showed that long term exposure to cooking leads to lung cancer, especially high among biomass fuel users than those who use LPG and electricity [22-24]. However, 36.10% of the participants who were suffering from the lung cancer have the family history of lung cancer; as in other studies showed increase in risk of lung cancer among those who had a history of cancer in their family [25].

In Table 4 there is positive association of tobacco smoking with lung cancer even after adjustment with other confounders [20]. It also showed that there is 1.03 times increase risk of lung cancer with increase in age as per other studies in Nepal [20, 21]. Respondents who were unemployed were also mostly associated with occurrence of lung cancer. Family history of cancer among immediate family members also showed strong association with occurrence of lung cancer. As per other studies there was 1.51 fold increase in risk of lung cancer among those who had history of cancer in their family [11]. In Nepal most of the household cook inside the house causing more exposure to second hand smoke [26], thus increasing the risk for occurrence of lung cancer [16, 27]. This may be due to use of fuels such as natural gas, kerosene, coal, wood, animal dung, and charcoal while cooking. This causes risk as per our study [4, 25]. Housewives are more at risk because they are the ones who are mainly exposed to indoor smoke especially while cooking [28].

Relighting of cigarettes while smoking is hazardous behavior due to formation of more tar and frequent lighting of the same cigarette as per studies done in the past in Manchester [6]. Our study also shows positive association with occurrence of lung cancer [6]. This may be because smokers who relight tend to smoke till the cigarette butt is short. This behavior could cause you to consume more tobacco and more tar which tends to produce more harmful substances that may lead to lung damage [7]. Other findings in this study showed incremental effect of lung cancer with the average number of cigarettes smoked per day similar other studies [6, 17, 20, 21]. Lung cancer also shows positive association with the use of unfiltered cigarette [20]. This habit while smoking cigarette causes more harm for occurrence of lung cancer. This study concludes that behavioral interventions by providing education and setting policies while smoking can minimize the occurrence of lung cancer. Relighting is intervened will minimize the impact of occurrence of lung cancer.

CONCLUSION

As per our research question, smoking and

relighting of cigarette butts were major positively associated risk factors for occurrence of lung cancer. This strengthens the prevention aspect of tobacco control program which is mainly focuses on quitting cigarettes and changing behavior for reducing relighting of cigarette butts among the general population and by teaching them not to relight cigarettes once extinguished and also reducing tobacco addiction among the general population in Nepal. This long term behavioral intervention programs and policies will help minimize the impact of occurrence of lung cancer. In future further in-depth studies need to be done regarding relighting of cigarette butts.

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