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Research Article

Coal Mines as Hot Spot of Infectious Diseases: Assessment of HCV related occupational Risk Factors among Coal Miners

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ABSTRACT

Several factors responsible for HCV have been investigated in general population but no such study has been documented about HCV status of coal workers in Pakistan. This study was conducted to determine the prevalence and factors responsible for HCV seropositivity among coal workers.

This cross sectional study was conducted among 311 randomly selected coal workers belonging to different job categories. Data collection was based on structured questionnaire including detail of personal characteristics, age, status and living conditions, alcohol and niswar consumption, occupational history and occupation characteristics. Seroprevalance test were carried out to detect HCV positive individuals. Confirmation of seropositivity was carried out by ELISA.

Prevalence of HCV among coal mine workers was higher than reported in general population. Screening and confirmation results revealed that 20.9% coal miners under study were HCV positive that is greater than general population. Sharing razors, niswar, having injection, and homosexuality were among other factors significantly increasing the chances of acquiring hepatitis. HCV was associated with Razor sharing (OR=17.949, 95 % CI=2.922,110.270), use of niswar (OR=10.336, 95 % CI=1.102 ,96.958), sharing of niswar (OR=7.007 ,95% CI=1.181,41.578), armpit shaving (OR=7.813,95% CI=2.063-29.589) ,homosexuality (OR=4.039, 95 % CI=1.121,14.559), residential area (OR=5.967, 95% CI =1.294-27.508), cut in mouth (OR=7.075,95%CI=1.875,26.692),Cut in skin(OR=5.679,95%CI 1.518,21.251), room sharing (OR=5.477,95% CI=1.621,18.508),Alcohol(OR=4.250,95%CI=1.328, 13.599) and use of therapeutic injections (OR=4.850,95%CI=1.682,13.989) were among chief factors significantly increasing the chances of acquiring hepatitis.Mine related occupational factors play contributory role in acquiring and progression of HCV among coal mine workers.

Keywords: Infectious diseases, HCV, coal miners, confined space, sharing practices, occupational risk factors

INTRODUCTION

Working world is liable to continuous changes that put multifaceted challenges to the individuals engaged in variety of tasks over there. One of the intricate challenges among them is exposure to biological agents that form the root cause of biological hazards. All micro- and macro-organisms along with their byproducts are considered as occupational biohazards and are capable of producing deleterious health effects among workers present in that particular environment (1).Modes like oral inoculation, respiratory or mucous membrane and bites of arthropods facilitate transmission of those biological agents that are responsible for diseases like HIV, Hepatitis, Melioidosis, typhoid fever, Schistosomiasis, malaria, dengue and scrub typhus (2).

Hepatitis B, C and HIV fall under the category of blood born infections. Infectious body fluid, large and repeated percutonous exposure to blood (3), Occupational percutaneous mucosal exposures (PMEs) that includes sharps injuries; direct inoculation of virus into percutaneous scratches, skin lesions, abrasions, burns and inoculation of virus onto mucosal surfaces of the eyes, nose, or mouth through accidental splashes play role in the transmission of HIV, HBV and HCV (4) .

HCV is caused by RNA virus called Hepacivirus. Hepatitis C infection is symptomized by progressive hepatic fibrosis followed by cirrhosis and hepatocellular carcinoma. Frequency of infection is increased manifold as HCV virus can survive on environmental surfaces up to six weeks (5).Contaminated implements such as straws and spoons that are frequently used for nasal inhalation of powdered drugs such as heroin, cocaine, methamphetamines and niswar play significant role in transmission of HCV. Barber shops are also considered as hot spots for spread of blood borne pathogens (6).

Most of the barbers in third world settings are unaware of the drastic effects of repeated usage of razors and scissors without sterilization on different customers (7). This is one of the most probable non sexual cultural practice that keep on exposing people to blood borne pathogens through sharing of contaminated instruments (8) , including medicinal bloodletting, ritual establishing' blood brotherhood', ritual and medicinal enemas, ritual scarification, group circumcization and genital tattooing (6).

HCV is most prevalent type of hepatitis in population of Pakistan (9) . Furthermore, several factors responsible for HCV infection and dissemination have been investigated in general population (10-12) and with reference to specific occupations (7, 13, 14) but no such study is documented about HVC status of coal workers .Feeling severity of problem present study was designed to investigate the prevalence of HCV as well as identification of risk factors of HCV associated with this occupation.

MATERIAL AND METHODS:

Present study was carried out to investigate the prevalence of HCV among coal miners via clinical diagnosis methods. The project also covered role of different risk factors involved in spreading of HCV. Study design was cross sectional. Target population included coal workers of district Chakwal, Khushab and Mianwali. A sum total of n= 311 workers belonging to five different work categories viz., Coal cutter, Shovelers, Coal lifters, Loader and Mine supervisor were included in studies.

Initial screening: screening was carried out via one step rapid test device (Acu-check HCV) that was based on lateral flow of chromatographic immunoassay following the principle of double antigen-sandwich technique.

Final screening: After initial screening seropositive individuals were subjected toward ELISA based method.

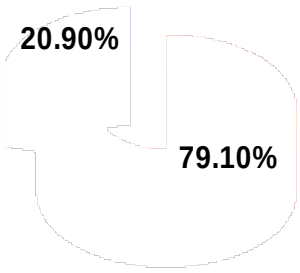
Statistical analysis:

Multinomial Regression analysis was carried through SPSS.

RESULTS:

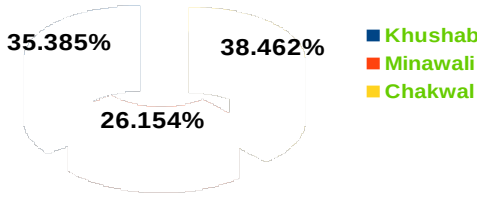
Statistical analysis revealed that out of 311 coal workers, 65 (20.9%) have seropositivity for Hepatitis C (Fig 1).

Fig 1.Prevalance of HCV at Coal Mines



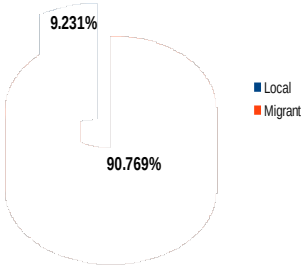
Area wise distribution showed that highest percentage of Hepatitis C +ve workers were residents of chakwal (38.46%) followed by Khushab (35.39%) and Mianwali (26.15%) (Fig 2).

Fig 2.Area wise prevalance of HCV



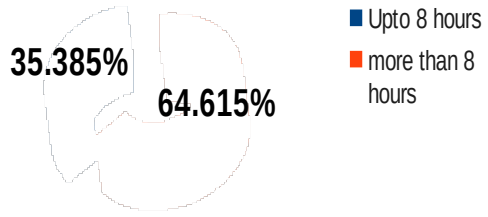
Migrants were more affected by hepatitis C as compared to local workers. Out of 65 workers 90.77% were migrant belonging to far most areas of the country (Tribal Areas, NWFP) while only 9.23% were local residents (Fig 3).

Fig 3.Prevalance of HCV on the basis of Residential Status



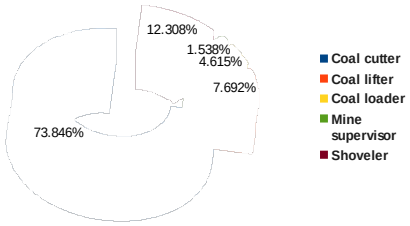
Work duration analysis showed that workers who were involved in carrying out their task for more than 8 hours (64.62%) become more prone to Hepatitis C as compared to those who work for 8 hours or less (35.39%) (Fig 4).

Fig 4.prevalance of HCV based on working hours



Coal cutter was the most affected category by Hepatitis among coal workers, as out of 126 coal cutters 73.846% were infected by virus of Hepatitis. Coal cutters were followed by shovelers (12.31%), coal lifter (7.69%) and coal loader (4.62%). Mine supervisor were among least affected one with percentage of 1.54% (Fig 5).

Fig 5.Prevalance of HCV among job categories



Study of risk factors associated with HCV among coal miners

Percentage comparison of Risk Factor for Hepatitis +ve workers and Hepatitis –ve workers is presented in table 1. Majority of workers suffering from hepatitis were migrant (90.8%) as compared to local residents (9.2%). Among the non-sufferers of Hepatitis 48.8% were local residents while 51.2 % were migrants. 93.8% workers who were having seropositivity of Hepatitis were performing their tasks in confined space while 74% non-sufferers were also performing their activities in these closed spaces.

Sharing of safety razors was common practice among seropositive workers as 95.4% workers reported that share safety razors with each other. Contrarily, sharing of safety razors among other group was 53.7%. Shaving of armpit was also done by 83.1% seropositive workers while 53.3% sero negative workers.

58 out of 65 workers having Hepatitis reported that they were sharing their room with more than four persons. Among those who were not affected by Hepatitis C virus 43.5 % were sharing room with more than four persons while 56.5 % were those who were sharing room with 2 or less than two persons.

Use of niswar and sharing of niswar was in routine practice. 96.9 % Hepatitis positive and 61.8% Hepatitis negative was using niswar during work as well as leisure time. 93.8 percent seropositive workers were sharing niswar with each other.61.5% hepatitis positive workers confessed that that use alcohol while percentage of alcohol users among others was 26.8%.

Homosexual activities were also confessed in front of local translator who accompanied us during visit of mines. Fifty four seropositive workers were indulging in homosexual activities.

80% seropositive while 67.1% seronegative workers reported that that they have cut or injured skin due to laborious work of coal loading, excavation, lifting or shoveling activities. Skin laceration percentage among above mentioned groups remained as 70.8 and 60.2 respectively. 86.2% seropositive workers also reported that they have cuts inside their mouth.

Only 15.4 % seropositive were satisfied with ventilation at mining sites while 84.6 % reported inadequate ventilation. 76.9 % coal workers confessed that they have received therapeutic injection during last five years for different daily routine diseases.

Majority of workers having Hepatitis (80%) reported that they use to smoke during work inside coal mines or during leisure time. 64.6% workers belonging to same group reported that they drink water stored into open water containers.

Multinomial regression analysis revealed sixteen different risk factors for Hepatitis C among coal workers. Eleven factors were found significantly associated with Hepatitis. Habit of sharing razor was increasing the chances of hepatitis at the rate of approximately 18 times among coal workers (Table 2).

Its coefficient contained positive value and have odds ratio of 17.949 (Cl=2.922- 110.270). Second important factor was use of niswar among workers. The logistic regression coefficient for use of niswar had a positive value of 2.336 and odds ratio (OR) 10.336, which is greater than 1 with a 95% CI of 1.102 to 96.958.This suggest that workers who use niswar have more than 10 times greater chances to develop Hepatitis C than those who do not use it. Niswar sharing was also common among workers which was increasing the chances of acquiring hepatitis at the rate of 7.007 (CI=1.181 to 41.578, $p<0.05$).

Table 1: Percentage Comparison of Occupational Risk Factors in Hepatitis +ve and Hepatitis –ve workers

Variable	Response	Hepatitis C +ve	Hepatitis C –ve
Residential Area	Local	6(9.2%)	120(48.8%)
	Migrant	59(90.8%)	126(51.2%)
Work in Confined Space	Yes	61(93.8%)	182(74.0%)
	No	4(6.2%)	64(26.0%)
Razor sharing	Yes	62 (95.4%)	132(53.7%)
	No	3(4.6%)	114(46.3%)
How many live in the same room	Less Than Two	7(10.8%)	139(56.5%)
	More Than Four	58(89.2%)	107(43.5%)
Armpit shaving	Yes	54(83.1%)	131(53.3%)
	No	11(16.9%)	115(46.7%)
Homosexuality	Yes	54(83.1%)	159(64.6%)
	No	11(16.9%)	87(35.4%)
Use Niswar	Yes	63(96.9%)	152(61.8%)
	No	2(3.1%)	94(38.2%)
Share Niswar	Yes	61(93.8%)	99(40.2%)
	No	4(6.2%)	147(59.8%)
Use Alcohol	Yes	40(61.5%)	66(26.8%)
	No	25(38.5%)	180(73.2%)

Have any cut on skin due to work	Yes	52(80%)	165(67.1%)
	No	13(20%)	81(32.9%)
Skin Lacerations	Yes	46(70.8%)	148(60.2%)
	No	19(29.2%)	98(39.8%)
Have Any Cut in Mouth	Yes	56(86.2%)	172(69.9%)
	No	9(13.8%)	74(30.1%)
Ventilation	Adequate	10(15.4%)	110(44.7%)
	Inadequate	55(84.6%)	136(55.3%)
Received therapeutic injections in last 5 years	No	15(23.1%)	127(51.6%)
	Yes	50(76.9%)	119(48.4%)
Smoking	Yes	52(80%)	114(46.3%)
	No	13(20%)	132(53.7%)
Drinking water present in what type of container?	Open	42(64.6%)	138(56.1%)
	Closed	23(35.4%)	108(43.9%)

Shaving of armpits and Homosexuality were two other important risk factors with odds ratio of 7.813 (95% CI=2.063-29.589) and 4.039 (95% CI=1.121 to 14.559) respectively. Practice of shaving armpits among workers was increasing the chances of hepatitis significantly. This practice increase about 8 times the likelihood of hepatitis. It was also noted that there was a significant relationship between residential area and Hepatitis (*p<0.01*). Migrants were 5.967 (95% CI =1.294-27.508,*p<0.01*) times more likely to suffer from hepatitis than local residents. The likelihood increased to 5.477 (95% CI=1.621-18.508*p<0.01*) times for the workers who were sharing room with more than four co-workers (Table. 2).

It was found that chances were about seven times greater to develop Hepatitis C with cut in the mouth. Cut in any part of skin had positive association with Hepatitis C and workers having skin cut have about 5.679 times more chances to develop Hepatitis C.

Another significant factor while running multiple logistic regressions was use of therapeutic injections in last five years. This showed that workers who received therapeutic injections had five times more chances to have Hepatitis C. Habit of using alcohol was making workers more susceptible to hepatitis as compared to non-users.

Estimated Logistic Regression Model(s):

Model for Hepatitis C = Hepatitis +ve

17.544+1.786*(Residential_area="migrant")+0.179*(confined_space="yes")+2.888*(razor_sharing="yes") +1.701*(how_many_live="more than four") +2.056*(shv_ armpit ="yes") +1.396*("Homo_sex="yes")+2.336*(use_niswar="yes")+1.947*(share_niswar="yes")+1.447*(use_alcohol="yes")+0.650*(venti="inadequate")0.323*(skin_lacerations="yes")+1.957*(cut_mouth="yes")+1.737*(skin_cut ="yes")+1.579*(Received_therapeutic injections="yes")+ 0.659*(smoking="yes") + 0.340*(Drinking_water="yes")

DISCUSSION

HCV is most prevalent hepatitis in population of Pakistan (9) as compared to neighboring countries (15) . Coal mine workers belonging to poor strata, sharing multiple personal items, having low level of awareness about infectious disease are one of most vulnerable category of working world. Present study was aimed to know the prevalence of HCV infection among coal mine workers of Punjab as well as identification of risk factors of HCV associated with this occupation.

HCV prevalence rate was much higher (20.9%) among coal workers as compared to general population of Pakistan (6.5%) (16) . Area wise differences (Fig 2) were also observed as miners of Chakwal area (38.46%) were more affected as compared to Khushab (35.39%) and Mianwali (26.15%). This difference could be due to geographical variations (17). Kauhl and his team also reported that prevalence of HCV not only varies among countries but also within small geographic scales such as postal code areas. Another possible reason might be due to

difference of knowledge, attitude and access to awareness about risk factors (14).

HCV prevalence also showed variation along with variation among job tasks, as coal cutters were most affected with HCV as compared to coal loader, coal lifter, shovelers and mine supervisors (Fig 6). This could be due to continuous inhalation of coal dust among coal cutters, which make their immune system weaker, making them more vulnerable to HCV attack.

Table:2 Multinomial Regression Analysis of Occupational Risk Factors Associated With Hepatitis C among Coal Workers

Variable	B	S.E	Wald-Statistics	p-Value	β	95% C.I For β	
						Lower	Upper
Residential Area	1.786	.780	5.248	**.022**	5.967	1.294	27.508
Work in Confined Space	.179	.998	.032	.858	1.196	.169	8.455
Razor sharing	2.888	.926	9.719	**.002**	17.949	2.922	110.270
How many Live in the same room	1.701	.621	7.494	**.006**	5.477	1.621	18.508
Armpit shaving	2.056	.679	9.155	**.002**	7.813	2.063	29.589
Homosexuality	1.396	.654	4.555	**.033**	4.039	1.121	14.559
Use Niswar	2.336	1.142	4.182	**.041**	10.336	1.102	96.958
Share Niswar	1.947	.908	4.593	**.032**	7.007	1.181	41.578
Use Alcohol	1.447	.593	5.944	**.015**	4.250	1.328	13.599
Have any cut on skin due to work	1.737	.673	6.654	**.010**	5.679	1.518	21.251
Skin Lacerations	-.323	.640	.254	.614	.724	.206	2.540
Have any Cut in mouth	1.957	.677	8.341	**.004**	7.075	1.875	26.692
Ventilation	.650	.739	.773	.379	1.916	.450	8.164
Received therapeutic injections in last 5 years	1.579	.540	8.536	**.003**	4.850	1.682	13.989
Eat food at workplace	.659	.710	.860	.354	1.932	.480	7.774
Drinking water present in what type of container?	.340	.648	.276	.600	1.405	.395	5.007
Constant	-17.5	2.695	42.366	.000			

Migration to and from mining sites was also responsible for HCV prevalence as 90.77% affected persons were migrants (Fig 3). Circular migrants are at more risk because of their poor and risky health conditions as well as health coverage has not been provided by employer due to their temporary nature of job (18). Migrants were having 5.967% more chances of contracting Hepatitis as compared to local workers.

Coal mine workers belonging to poor strata, sharing multiple personal items, having low level of awareness about infectious disease are one of most vulnerable category of working world. Present study was aimed to know the prevalence of HCV infection among coal mine workers of Punjab as well as identification of risk factors of HCV associated with this occupation.HCV prevalence rate was much higher (20.9%) among coal workers as compared to general population of Pakistan (6.5%) (16) .

We sought to assess the risk factors for HCV associated with this occupation among individuals performing different job task at coal mines. I have identified eleven risk factors that were significantly associated with HCV. Sharing of safety razors appeared as strong factor with OR=17.95 for HCV seropositivity among coal workers.

These poor strata of population think that one razor is enough and safe for shave of all the members belonging to same family or area. Coal workers were in usual habit of sharing safety razors. Microtruma can be resulted from shaving that contaminates the shaving instrument. Reuse of such safety razor contaminated with the blood of infected person could be an effective vehicle for transferring HCV (7). HCV virus can maintain

infectivity on the contaminated surface up to six weeks (5).

Shaving of armpits appeared as another important risk factor for seropositivity of HCV. Most of the workers who were shaving their armpits were also use to share their razors. Percentage of razor sharing among HCV positive workers was 95.4% while 83.1% were in the habit of shaving the armpits. Contaminated razors when used for shaving of armpits, micro trauma of thin stratum corneum in this part facilitate the entry of HCV. Many workers (10, 11, 19) reported armpit shaving as possible route for HCV transmission.

Room sharing by more than four workers was increasing the chances of Hepatitis at the rate of 5 times (OR=5.477). The possible reason could be that when multiple person reside in the same room percentage of sharing personal items also increase (razor, nail cutters).

Use of niswar, use of alcohol, sharing of niswar and having cut in the mouth were increasing the risk of Hepatitis at rate of 10 times (10.336), 4 times (4.250) and 7 times (7.007) and (7.075) respectively. Sharing the same packet of niswar might be involved in transferring HCV containing mucus secretion from non-infected to infected person. Cut or oral sore further exacerbate the transmission of HCV (Fischer (20) et al., 2008). Singal and Anand (21) also found highly prevalent HCV among alcohol users . High prevalence among alcohol user might be due to enhanced exposure to HCV and low viral clearance among excessive alcohol users (22). High intake of alcohol further exacerbate fibrotic progression and cirrhotic outcomes (23-33) .

Use of therapeutic injection was increasing the chances of HCV at the rate 4.850 as compared to those who did not receive any type of injection during last five years. Luby (16) and Bari (34) also found marked relationship between average number of therapeutic injections and HCV infection. Unsafe injection practices facilitate the transmission of blood borne pathogens like HCV (35, 36) .

Homosexuality was also significantly associated with being the part of this study. Most of miners were migrant who remain away from their houses for most of the time. Majority reported that only visit their house on Eid festivals. Sexual desire indulges them into such activities. Poor ventilation of workplace was another risk factor for HCV. Bivariate analysis revealed its significant association with HCV but not by multiple logistic analyses. This study stand by with Marques's (37), who suggested that poor ventilation system increase the infection risk.

Conflict of Interest: None

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