Arsenosis is one of the Predisposing Factor of Carcinoma of Lung in Non- Smokers

Ali Raza Memon[1], Rafiq Ahmed Jalbani[1], Tanveer Ahmed Shaikh[2]

[1]Department of Biochemistry, Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro, Sindh, Pakistan.
[2]Department of Pathology, Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro, Sindh, Pakistan.
aliraza_dr@outlook.com

Abstract: The cause of lung cancer is commonly ascribed to tobacco smoking. Arsenic is the prominent non-tobacco carcinogens strongly associated with lung cancer carcinoma. The study identified 65 lung cancer cases and 40 controls, in which 46 males and 19 females, histologically 52 cases of Squamous Cell Carcinoma of lung and 13 were Adenocarcinoma of lung. These 65 diagnosed cases all are non-smokers. The arsenic in the samples was determined by Atomic Absorption Spectrophotometry. We examine the relationship between lung cancer and arsenic in a case-control study involving patients diagnosed with lung cancer between 2011 and 2012 and controls. The blood samples were collected from the Department of Oncology, NIMRA Centre, LUMHS, Jamshoro. The results indicate that the level of arsenic was significantly higher in non-smokers as compared to controls ($p<0.01$). This study confirms the increased risk of lung carcinoma in non- smokers in relation to Arsenic concentrations in blood and water.

[Ali Raza Memon, Rafiq Ahmed Jalbani, Tanveer Ahmed Shaik. **Arsenosis is one of the Predisposing Factor of Carcinoma of Lung in Non- Smokers.** *J Am Sci* 2019;15(3):60-63]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). http://www.jofamericanscience.org. 9. doi:10.7537/marsjas150319.09.

Key words: Arsenic, Lung cancer, Non- Smokers.

1. Introduction

Humans are exposed to arsenic through environmental and occupational sources. Lung cancer is known to be caused by occupational exposure to arsenic via inhalation **(1)**. The most extensive human exposure to arsenic, however, results from naturally occurring arsenic in drinking water, long known to be a cause of cancer. Unexpected facts, originating from studies in Asia, indicated that the ingestion of arsenic also increases mortality from cancer originate in different inside positions including lungs. **(2–9).** Further evidence of an association between the intake of arsenic and increased lung cancer risks, it is reported that in Japan involving residents using well water contaminated with arsenic **(10).**

The purpose of the present study was to examine arsenic and lung cancer in non-smokers with individual assessment of exposure based on arsenic concentrations in serum samples.

The International Agency for Research of Oncology has classified arsenic in drinking water as a known cause of human cancer of the skin, bladder, and lung (**4).** Numerous studies have shown that the human lung is especially susceptible to ingested arsenic (**5–9)** and some data suggest that lung cancer is the most common cause of death from arsenic in drinking water (**10).**

Arsenicosis, arsenic toxicity due to chronic exposure, manifests itself as a variety of diseases of the dermal, cardiovascular, nervous, hepatic, hematological, endocrine and renal systems **(11, 12)** The lifetime mortality from arsenic-related internal cancers has been estimated to be doubled due to arsenic in drinking water in Bangladeshi population, compared with historical estimates in the absence of arsenic exposure **(13).**

2. Material and Methods

The blood samples were collected from Department of Oncology, NIMRA, LUMHS, Jamshoro. A questionnaire containing a comprehensive record of all patients was completed from each patient. Digital X- ray and CT Scan Chest were being done for all patients. For each residence, participants were asked about drinking water sources (Private well, Community Supply, Bottled water, or other) and filter use at the time they lived there. Questions regarding tobacco covered ages when smoking started and stopped. Histologically reports also showed that 52 cases were of Squamous Cell Carcinoma of lung and 13 were Adenocarcinoma of lung.

Chemicals, Reagents and Stock Solutions and working Metal standards

Concentrated nitric acid (65%) and hydrogen peroxide (30%) were obtained from Merck (Darmstadt, Germany) and Working standard solutions of Arsenic, was prepared prior to their use by stepwise dilution of certified standard solutions (1,000 ppm; Fluka Kamica, Buchs, Switzerland) in 0.2 M HNO3.

All chemicals were of analytical grade.

Statistical analyses were performed with Excel X State computer program (Microsoft Corp., Redmond, WA, USA)

Demographic Table

Table 1. Demographic Table

65diagnosed cases (non-smokers)	**46 males 19 females)**
40-50 years	**7males 3females = 10 cases**
51-60 years	**9 males 4 females = 13 cases.**
61-70 years	**18 males 09 females = 27 cases**
>71 years	**12 males 3 females = 15 cases.**

3. Results

The mean concentrations with standard deviations for Arsenic in the samples are shown in Table 1 and Fig: 1 the levels of blood Arsenic were found to be in patients 6.07±0.31 and in controls 2.04±0.21. All values are shown as mean ± SEM.

Table: 1

Metal	Patients	Controls
Arsenic	6.07±0.31	2.04±0.21

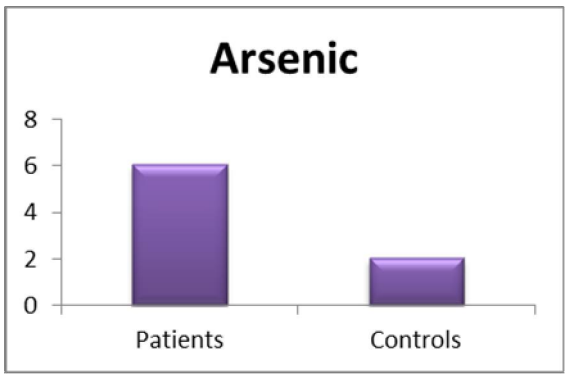

Fig: 1: shows arsenic levels with controls

4. Discussions

In the present study, we determine level of arsenic in serum samples of patients with lung carcinoma in non- smokers persons. We observed a high level of arsenic in serum samples in patients as compared with the controls. Results of this study suggested that peoples in this case control with a history of non-smoking and the effect of arsenic exposure from drinking water may be more susceptible to incident of lung cancer.

Chronic arsenic exposure is well established as carcinogenic but interest in the non-cancer disease endpoints of arsenic exposure is of great interest. The non-cancer disease endpoints include cardiovascular disease **[14]** and immune dysfunction **[15],** as well as neuropathies and ocular diseases **[16, 17, and 18].** In the present study, we focused on blood samples of lung carcinoma in non- smoker's in a population exposed to high levels of arsenic in serum.

Arsenic is also a known carcinogen **(19).** There is an evidence of an increased risk of bladder and skin cancers following the consumption of water with high arsenic contamination, and a risk of lung cancer following smoking as well as non-smoking **(20, 21)**. A causal association has been established between the exposure to environmental tobacco smoke and lung cancer, with a relative risk in the order **(22, 23).** The arsenic levels in the serum and blood cells correlate with worsening kidney disease, with the development and progression of chronic kidney disease, which are attributed to arsenic-induced oxidative stress **(24).**

A problematical situation is noticed in Pakistan and other countries, where people are chronically exposed to as from contaminated groundwater due to lack of pure and clean drinking water; however, there are some other co-factors that increase or accelerate the toxic effects of Arsenic, i.e., malnutrition and smoking **(25)**. The high levels of arsenic in the aquatic environment may cause tracheobronchitis, rhinitis, and pharyngitis, shortness of breath, nasal congestions, and black foot disease **(26).**

The role of gender on respiratory effects remains somewhat unclear. It is reported that, two studies from India a higher risk for respiratory symptoms in males, while one from Bangladesh found a higher risk in females. **(27,28)** Interestingly, one study reported a higher risk for respiratory symptoms among males, but observed statistically significant effects only among females exposed to high levels of As.11 We found that there was a higher risk in females compared with males (HR 1.35, 95% CI 1.17 to 1.56) after adjusting for smoking status. The dose response relationship between as exposure levels and respiratory symptoms however does not differ appreciably by gender (data not shown). Other factors such as nutritional factors and indoor air pollution from cooking might explain some of the differences in risks across gender11 25 28; however, more research is needed to uncover the underlying mechanisms.

5. Conclusion

It is concluded that arsenic in blood is not only associated with an increased level of reactive oxygen radicals but is also inversely related to the antioxidant capacity in plasma of humans. The results of this

study indicate that arsenic is a significant environmental toxicant that increases the risk of Cancer. More research is still needed to understand arsenic exposure, metabolism, effects, and for cancer. This knowledge will lead to better protection of populations at risk from arsenic-related illnesses.

Corresponding Author:
Dr. Ali Raza Memon
Department of Biochemistry, Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro, Sindh, Pakistan.
E-mail: aliraza_dr@outlook.com

References

1. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. vol. 23. Some Metals and Metallic Compounds. Lyon: International Agency for Research on Cancer, 1980;39 –141.
2. Chen CJ, Chuang YC, Lin TM, Wu HY. Malignant neoplasms among residents of a blackfoot disease-endemic area in Taiwan: high-arsenic artesian well water and cancers. Cancer Res 1985;45:5895–5899.
3. Chen CJ, Chuang YC, You SL, Lin TM, Wu HY. A retrospective study on malignant neoplasms of bladder, lung and liver in blackfoot disease endemic area in Taiwan. Br J Cancer 1986;53:399–405.
4. Chen CJ, Kuo TL, Wu MM. Arsenic and cancers (Letter). Lancet 1988;1: 414–415.
5. Chen CJ, Wu MM, Lee SS, Wang JD, Cheng SH, Wu HY. Atherogenicity and carcinogenicity of high arsenic artesian well water: multiple risk factors and related malignant neoplasms of blackfoot disease. Arteriosclerosis 1988; 8:452–460.
6. Wu MM, Kuo TL, Hwang YH, Chen CJ. Dose-response relation between arsenic concentration in well water and mortality from cancers and vascular diseases. Am J Epidemiol 1989;130:1123–1132. Grytnes JA, Vetaas OR. Species richness and altitude: A comparison between null models and interpolated plant species richness along the Himalayan altitudinal gradient, Nepal. The Am Nat 2002;159(3):294-304.
7. Chiou HY, Hsueh YM, Liaw KF, Horng SF, Chiang MH, Pu YS, Lin JS, Huang CH, Chen CJ. Incidence of Internal cancers and ingested inorganic arsenic: a seven-year follow-up study in Taiwan. Cancer Res 1995;55:1296–1300.
8. Chen CJ, Chen CW, Wu MM, Kuo TL. Cancer potential in liver, lung, bladder and kidney due to ingested inorganic arsenic in drinking water. Br J Cancer 1992;66:888–892.
9. Bates MN, Smith AH, Hopenhayn-Rich C. Arsenic ingestion and internal cancers: a review. Am J Epidemiol 1992;135:462– 476.
10. Tsuda T, Babazono A, Yamamoto E, Kurumatani N, Mino Y, Ogawa T, Kishi Y, Aoyama H. Ingested arsenic and internal cancer: a historical cohort study followed for 33 years. Am J Epidemiol 1995;141:198 –209.
11. Hughes, M.F., 2002. Arsenic toxicity and potential mechanisms of action. Toxicol. Lett. 133, 1–16. NRC, 1999. Arsenic in drinking water. In: Water, S.O.A.I.D., Toxicology, C.O.T.B.O.E.S.A., Sciences, C.O.L. (Eds.). National Academy Press, Washington, DC.
12. Nriagu, J.O., 1994. Arsenic in the Environment. Part II. Human Health and Ecosystem Effects. Wiley & Sons, Inc.
13. Chen, Y., Ahsan, H., 2004. Cancer burden from arsenic in drinking water in Bangladesh. Am. J. Public Health 94, 741–744.
14. States JC, Srivastava S, Chen Y, Barchowsky A: Arsenic and Cardiovascular disease. Toxicol Sci 2009, 107(Suppl 2):312–323.
15. Ghosh P, Banerjee M, De Chaudhuri S, Chowdhury R, Das JK, Mukherjee A, Sarkar AK, Mondal L, Baidya K, Sau TJ, Banerjee A, Basu A, Chaudhuri K, Ray K, Giri AK: Comparison of health effects between individuals with and without skin lesions in the population exposed to arsenic through drinking water in West Bengal, India. J Expo Sci Environ Epidemiol 2007,17(Suppl 3):215–223.
16. States JC, Barchowsky A, Cartwright IL, Reichard JF, Futscher BW, Lantz RC: Arsenic toxicology: translating between experimental models and human pathology. Environ Health Perspect 2011, 119(Suppl 10):1356–1363.
17. Banerjee N, Nandy S, Kearns JK, Bandyopadhyay AK, Das JK, Majumder P, Basu S, Banerjee S, Sau TJ, States JC, Giri AK: Polymorphisms in the TNF-α and IL10 gene promoters and risk of arsenic-induced skin lesions and other nondermatological health effects. Toxicol Sci 2011, 121(Suppl 1):132–139.
18. Kundu M, Ghosh P, Mitra S, Das JK, Sau TJ, Banerjee S, States JC, Giri AK: Precancerous and non-cancer disease endpoints of chronic arsenic exposure: the level of chromosomal damage and XRCC3 T241M polymorphism. Mutat Res 2011, 706(Suppl 1–2):7–12.
19. Chiou HY, Hsueh YM, Liaw KF, et al. Incidence of internal cancers and ingested inorganic

arsenic: a seven-year follow-up study in Taiwan. Cancer Research.1995;55:1296–1300.
20. Boffetta P, Nyberg F. Contribution of environmental factors to cancer risk. Br Med Bull. 2003;68:71–94.
21. Rossman TG. Mechanism of arsenic carcinogenesis: An integrated approach. Mutat Res. 2003;533:37–65.
22. Brima EI, Haris PI, Jenkin RO, Polya DA, Gault AG, Harrington CF (2006) Understanding arsenic metabolism through a comparative study of arsenic levels in the urine, hair and fingernails of healthy volunteers from three unexposed ethnic groups in the United Kingdom. Toxicol Appl Pharmacol 216:122–130.
23. Agusa T, Kunito T, Fujihara J, Kubota R, Minh TB, Trang PTK, Iwata H, Subramanian A, Viet.
24. Mitra SR, Guha-Mazumder DN, Basu A, Block G, Haque R, Samantha S, Ghosh N, Hira-Smith MM, Von-Ehrenstein OS, Smith H (2004) Nutritional factors and susceptibility to arsenic-caused skin lesions in West Bengal, India. Environ Health Perspect 112:1104–1109.
25. Wasserman GA, Liu X, Parvez F, Ahsan H, Factor-Litvak P, Geen VA, Slavkovich V, Lolacono NJ, Cheng Z, Hussain I, Momotaj H, Graziano JH (2004) Water arsenic exposure and children's intellectual function in Araihazar, Bangladesh. Environ Health Perspect 112:1329–1333.
26. Mead MN (2005) Arsenic: in search of an antidote to a global poison. Environ Health Perspect 113: A378–A386.
27. Jack CN, Wang J, Shraim A (2003) A global health problem caused by arsenic from natural sources. Chemosphere 52:1353–1359.
28. Yuan, Y.; Marshall, G.; Ferreccio, C.; Steinmaus, C.; Selvin, S.; Liaw, J.; Bates, M.N.; Smith, A.H. Acute myocardial infarction mortality in comparison with lung and bladder cancer mortality in arsenic-exposed region II of Chile from 1950 to 2000. *Am. J. Epidemiol.* 2007, *166*, 1381–1391.
29. Agarwal Sanjay K, Dash Suresh Candra. Incidence of chronic kidney disease in India. Nephrl Dial Transplant. 2006;21:232.

3/19/2019