

Effect of drinking arsenic safe water for ten years in an arsenic exposed population: Study in West Bengal, India

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ABSTRACT: A study was done in 2010–2011 on the cohort population of 2620 of previous epidemiological study done during 1995, assessing various levels and duration of arsenic exposure in the past and its impact on arsenical skin lesion following consumption of arsenic safe water in West Bengal, India. Following drinking of arsenic safe water 36 out of 131 mild cases of pigmentation (out of 2620 participants) had cleared the lesion, while 65 cases had mild (9 new appearance) and 24 had moderate pigmentation (1 new appearance) and 7 cases had severe pigmentation during present examination. Further, 17 out of 46 mild cases of keratosis cleared the lesion, 17 remained mild (1 new appearance), 11 cases became moderate keratosis and one case severe keratosis during the present examination. Increased severity of skin lesion even following taking safe water was found to be significantly associated with higher initial arsenic level and dose of arsenic exposure.

1 INTRODUCTION

Reports are scanty in the literature on long term effect of chronic arsenic toxicity after stoppage of drinking arsenic contaminated water on skin manifestations. The current report is based on a study done in 2010–2011 on the cohort population of previous epidemiological study carried out in south 24 Parganas, West Bengal during 1995, assessing various levels of arsenic exposure in the past and its impact on arsenical skin lesion following consumption of arsenic safe water. The object of the study is to ascertain the natural history of arsenical skin lesion following drinking of arsenic safe water in an arsenic affected population.

2 METHODS

A follow up study was done on a population of 5,562 residing in 947 households during 2010–11 that was a subgroup of group of population studied during 1995 (surveyed in South 24 Parganas). The details of method of selection of the previous 1995 epidemiological study done and analysis of their drinking water sources for arsenic level has been described earlier (GuhaMazumder *et al.*, 1998).

Each participant was questioned briefly about his or her sources of drinking water, diet and water intake and clinical symptoms; a general

medical examination was done, including a careful inspection for arsenic skin lesions. Water samples were collected from private and public tube wells used for drinking and cooking purposes by each recruited household. Arsenic levels were measured by flow-injection hydride generation atomic absorption spectrophotometer. The arsenic concentration in tube well water in the villages ranged up to 3400 µg/L. Supply of arsenic safe drinking water scheme had been completed by PHED, Govt. of West Bengal through deep tube wells from spot sources and supply of filtered surface water through pipe line system covering the nine arsenic affected blocks of the district of South 24 Parganas in the state since 2001 (PHED, 2013).

Here, in this present paper; however we have analyzed 2620 subjects because of the fact that they were drinking safe water 2 for at least 10 years after the stoppage of their earlier drinking of unsafe water. Hence this constituted a cohort that was first examined in 1995 and was kept under drinking of safe water afterwards and finally reexamined in 2010–11.

Each participant was questioned briefly about his or her current sources of drinking and cooking water, and duration of water use from the source. Demographic characteristics and socio economic condition of the participant was recorded in a proforma. All patients were examined in the field by the physicians who have had long years experience in diagnosing arsenic-caused skin lesions.

Evidence of drinking of relatively arsenic safe water (<0.05 mg/L) from current drinking water source was found in 2620 participants only during the follow up period. The present paper is hence based on outcome analysis of clinical status of arsenical skin lesion following drinking of arsenic safe water with correlation of arsenic exposure data in the past on these 2620 participants.

Arsenic level in drinking water source, duration of intake of arsenic contaminated water and cumulative arsenic dose of arsenic intake in the past was considered for correlation with severity of arsenical skin lesion in the past and during current examination.

3 RESULTS AND DISCUSSION

Data of previous study showed that mean arsenic level in drinking water in the past was Mean \pm SD 0.22 ± 0.24 mg/L. During the past examination 2488 subjects were found to have no pigmentation, while 131 cases had mild pigmentation and 1 case had moderate pigmentation. Following drinking of arsenic safe water 36 (27.48%) out of 131 mild cases of pigmentation (past arsenic level in drinking water was Mean \pm SE, 0.21 ± 0.005 mg/L) had clearance of the lesion, while 65 cases were found to have mild pigmentation (Including 9 subjects who had new appearance from subjects without any lesion in the past), 24 were found to have moderate pigmentation (1 case new appearance), and 7 cases were found to have severe pigmentation during present examination. In regard to keratosis during the past examination, 2574 subjects were found to have no lesion, while 46 cases had mild keratosis. Following drinking of arsenic safe water 17 (36.95%) out of 46 mild cases of keratosis (past arsenic level in drinking water, Mean \pm SE, 0.22 ± 0.005 mg/L) cleared the lesion, 17 cases were found to have mild keratosis (with one case of new appearance from subjects without lesion), 11 cases were found to have moderate pigmentation and one case was found to have severe keratosis during the present examination. It was further observed that higher the level of arsenic intake in the past, higher was the severity of pigmentation and keratosis observed during current examination and the dose response relationship was found to be statistically significant.

It was evident from the study that significant improvement had taken place in regard to status of both pigmentation and keratosis after intake of arsenic safe drinking water for a prolonged period (2001–2010)² in an arsenic exposed population. However increment of severity and new appearance of pigmentation and keratosis were observed

in significant number of cases in spite of drinking arsenic safe water for a prolonged period. It was further observed that higher the level of arsenic intake and cumulative dose of arsenic exposure in the past, higher was the progression of severity of pigmentation and keratosis observed during current examination and the dose response relationship was found to be statistically significant. It was observed that only male gender was more prone to be associated with non improvement of both skin lesions after drinking arsenic safe water.

A few studies conducted earlier investigated the effect of drinking arsenic free water on arsenical skin lesion caused by ground water arsenic contamination highlighting either improvement of skin lesion or new appearance in a few (Tseng *et al.*, 1968, Yeh *et al.*, 1973, Guha Mazumder *et al.*, 2001, 2014, Sun *et al.*, 2006). However, the studies were carried out on small number of participants and for a short period of follow up. No study described increment of severity of skin lesion even after drinking arsenic safe water. Further individual exposure data in the past was not considered for assessing the outcome results of follow up study. Thus, a major strength of this study is that it is the first large population-based study with individual exposure data, followed up for a prolonged period following drinking arsenic safe water, which can provide critical information with which to characterize the exposure-response relationship in regard to effect of drinking arsenic safe water.

4 CONCLUSIONS

Intervention with arsenic safe water in West Bengal was found to be associated with clearance of arsenical skin lesion in people drinking water in the past with arsenic level less than Mean \pm SE, 0.21 ± 0.005 mg/L. However higher level of arsenic exposure in drinking water in the past was found to be associated with increment of severity or reappearance of new skin lesion in some of the arsenic exposed people in spite of drinking of arsenic safe water.

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