

Arsenicosis: Is it a Protective or Predisposing Factor for Mental Illness?

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Objective: Chronic arsenic poisoning (Arsenicosis) is a global health risk, and it has been reported to improve the fitness, especially in altitudinal sickness in therapeutic dose. Scarcity of systematic study on psychiatric co-morbidities in Arsenicosis motivated us to conduct this research. The aim of this study was to estimate the co-morbid psychiatric disorders in patients with arsenicosis and to examine whether natural arsenic exposure and toxicity is protective or detrimental for mental health.

Method: Out of 1477 arsenicosis patients aged 18 to 65 years, 1169 were finally assessed after excluding those who were disinclined to participate or those who had any organ failure or prior psychiatric disorder in themselves or their first-degree relatives. We applied General Health Questionnaire-12 (GHQ-12) and Brief Psychiatric Rating Scale (BPRS) to screen psychiatric symptoms. Finally, 191 patients with BPRS score > 30 were structurally interviewed using the Schedules for Clinical Assessment in Neuropsychiatry (SCAN).

Results: Of the 1169 participants in our study, 18.99 % of the arsenicosis patients had psychiatric ailments. Common psychiatric manifestations were depression (8.47%), mixed anxiety and depressive disorder (4.61%), adjustment disorder in the form of mixed anxiety and depressive reaction, and brief depressive reaction (2.22%), and suicidal attempts (1.53%).

Conclusion: Considering the higher prevalence of psychiatric ailments in arsenicosis compared to general population of the same territory, it is necessary to screen psychological disorders in them. Conducting studies with control groups to further evaluate the impact of arsenicosis on mental health is warranted.

Key words: Arsenic, Arsenic poisoning, Causality, Mental health

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Toxic level of arsenic exposure occurs through both anthropogenic and natural sources. Inorganic arsenic may be a natural contaminant of deep water wells. It may lead to acute and chronic toxicity. Intake of inorganic arsenic over a long period can lead to chronic arsenic poisoning (arsenicosis). Arsenic contamination of ground water has been found in many countries, including Argentina, Chile, China, India (West Bengal), Mexico, Taiwan, Thailand, Bangladesh and the United States of America, and is a global problem. The alarm was first raised when cases of arsenic-induced skin lesions were identified in West Bengal, India, in 1983. West Bengal is still one of the most widely arsenic affected areas in the world (1). Nevertheless, psychiatric co-morbidities in arsenicosis have rarely been discussed. Historically, the consumption of arsenic was quite common in the seventeenth century. This metal was, in fact, prescribed for a myriad of diseases (especially homeopathic or the Chinese pharmacopeia), and even as a beauty product

or an aphrodisiac. Among the reasons reported for consuming this poisonous metal, the enhanced ability to breathe easily during hikes in the mountains (2), a spike in courage, a boost in sexual potency, and a putative prophylactic effect against infections were reported (3). Hence, considering these data, we hypothesized that non-therapeutic natural arsenic exposure and thus toxicity may also be protective of mental illness. Our aim was to compare the prevalence of psychiatric ailments in arsenicosis patients, if any, with that of general population of the same terrain.

Materials and Method

Study Populations

This was a cross-sectional analytic study. Data were collected over thirteen months. The study was conducted within the most affected seven villages of the state of West Bengal, India where more than 90% of all the deep-water wells had been contaminated naturally with arsenic for the last twenty years. The range of arsenic concentration in drinking water was 25 to 900 ppb (4). Arsenicosis case was identified with

consumption of contaminated water for more than six months and characteristic skin melanosis and bilateral keratosis involving palms and soles (5). Currently, everyone avoids additional exposure and would take no other medicine. A total of 1477 arsenicosis patients with age range of 18 to 65 years were assessed for eligibility. An ethical board of the State Regional Mental Hospital reviewed and approved the protocols, and, after a complete description of the study to the subjects, written informed consent was obtained. Those who did not give informed consent (n=81) or had any organ failure (like lung, liver or kidney) (n=158) or prior psychiatric disorder in themselves or their first-degree relative (n= 69) were excluded.

Instruments

Participants’ psychological functioning was assessed with two standardized measures. We applied General Health Questionnaire-12 (GHQ-12) (6) and 18-item Brief Psychiatric Rating Scale (BPRS) (7) to 1169 arsenicosis patients. Both the instruments were clinician rated assessments of the severity of mental problems over the past few weeks. High scores indicated worse mental health. Any 3 positive scores on GHQ-12 identified a probable case. Assessment was conducted at the same time while visiting every house by a district special cell for arsenic toxicity and PSB was the psychiatrist assessing mental status at that team.

Finally, all 191 patients with BPRS score > 30 were structurally interviewed using the Schedules for Clinical Assessment in Neuropsychiatry (SCAN)

jointly by both the authors to diagnose psychiatric disorders as per ICD-10 DCR criteria (8).

Results

Majorities (59%) of participants in our sample were male and from lower socio-economic status (76.21%) (Table1). Less than one fourth of the patients were unemployed. Out of 1169 arsenicosis patients, 18.99 % of the patients were probable psychiatric cases (GHQ >2) and 16.34% had clinically significant psychopathology (BPRS score > 30). We divided those 191 patients according to severity of illness where ‘mildly ill’ corresponds to a BPRS score of 31, ‘moderately ill’ 41 and ‘markedly ill’ 53 (9). None had marked illness or overt psychosis. BPRS scores were further analyzed into symptom groups according to its four sub-scales measuring severity of hostile-suspicious, withdrawal-retardation, thinking disturbance, anxious-depression (10). The mean score of depression-anxiety symptom was highest (mean, 9.07±3.07) among these four subscales. Major psychiatry morbidity in arsenicosis patients was clinical depression in mild to moderate level (8.47%). In addition, 4.61% of the patients had mixed anxiety and depressive disorder, 2.22% adjustment disorder (mixed anxiety and depressive reaction, and brief depressive reaction), 0.77% substance use disorder (SUD) and 0.26% generalized anxiety disorder.

Table 1: Clinico-demographic profile of patients with arsenicosis

Variables	Arsenicosis patients (N=1169)	
	Mean (SD)	n (%)
Age in years	33.58	(11.90)
Sex (Male)	689	(58.94%)
Religion (Muslim)	989	(84.60%)
Education in years	9.94±4.33	
Marital status (Single or separated)	402	(34.4%)
Employment status (Unemployed)	256	(21.9%)
Socioeconomic class †		
Middle class	278	(23.79%)
Lower class	891	(76.21%)
GHQ score >2	222	(18.99 %)
BPRS score >30	191	(16.34%)
Mildly ill (BPRS score 31-40)	155	(13.26%)
Moderately ill (BPRS score 41-52)	36	(3.07%)
ICD-10 DCR diagnosis		
Depression	99	(8.47%)
Mixed anxiety and depressive disorder	54	(4.61%)
Adjustment disorder	26	(2.22%)
SUD	9	(0.77%)
GAD	3	(0.26%)
Suicidal attempt (at least once)	18	(1.53%)

Legend: † Socioeconomic class was assessed with Kuppuswamy's socioeconomic status scale (11), SUD= substance use disorder, GAD= generalized anxiety disorder

Cannabis use disorder (86%) is the most prevalent SUD. It is noteworthy to mention that 1.53% of arsenicosis patients attempted suicide at least once. The commonest agents used were organophosphates and other household poisons (71%).

Discussion

More than 1.5 million people were thought to be exposed to arsenic in India with more than 200000 cases of chronic poisoning⁵. In our study, 19 % of arsenicosis patients developed some or other psychiatric manifestation. Out of that 8.47% of arsenicosis patients had depression, 4.61% mixed anxiety and depressive disorder, 2.22% adjustment disorder, 0.77% SUD and 0.26% GAD. However, the prevalence of all mental disorders and depressive disorders in rural India was reported to be 70.5 and 37.4 per 1000 population respectively (12). Furthermore, prevalence rate for anxiety neurosis (combining depression and anxiety) was 18.5 per 1000 general population (13). Thus, prevalence of these psychiatric ailments in arsenicosis was higher than the general population of the same territory. Arsenicosis patients were having exclusively non-psychotic depression similar to what is seen in general population of India i.e. reactive depression is three times more than the psychotic depression (12). Lastly, crude annual suicide attempt rates reported to be between 49 per 100,000 to 81 per 100,000 in India (14). In arsenicosis patients, the suicide rate was much higher which has been ignored. Therefore, arsenic toxicity is not protective of mental health as it was found to be in some other physical illness such as mountain sickness, rather arsenic in drinking water is a hazard to human mental health. Mild to moderate mental illness is an usual manifestation. Anxiety and depression were the main psychiatric illnesses in arsenicosis patients which are also the most prevalent psychiatric disorders in the general population (12). Psychosocial stressors like lower socio-economic status and poor coping with lack of specific treatment and crippling diseases associated with arsenic poisoning were thought to be the predisposing factors of psychological decomposition. Body image, which may be affected by ugly skin appearances, is closely linked to self-esteem in human beings, and low self-esteem is a risk factor for depression. Nevertheless, extensive social networking of this society enabled them to maintain their traditional kinship and cast relations and cope with these stresses. Otherwise, they were expected to have more psychiatric morbidities.

Arsenic may be a natural contaminant of some deep water wells. Low level of exposure continues to take place in general population through the commercial use of inorganic arsenic compounds. Some of the organic arsenic is relatively nontoxic, but inorganic arsenic accumulates in the liver, spleen, kidneys, lungs, and gastrointestinal tract. It leaves a residue in keratin-rich tissues like skin, hair, and nails. Although sensory and motor polyneuritis has been documented, central

nervous system involvement has still not been described. Arsenic, particularly in its trivalent form, inhibits critical sulfhydryl-containing enzymes. In the pentavalent form, it rapidly hydrolyses the high-energy bonds in such compounds as ATP (15). Therefore, exact mechanisms for psychiatric illness are not obvious. We propose an unidentified neurochemical predisposition along with poor coping to tackle psychosocial stressors leading to these psychological ailments. Severity of this illness may be related to the amount and duration of exposure and valency of the metal. Moreover, the exact incidence and prevalence of psychiatric complications of arsenicosis are not yet known. In the future, an epidemiological or prospective cohort study should be used to rule out common causal hypotheses and to estimate prevalence.

Conclusion

Mental disorders in arsenicosis patients on the whole remain unnoticed. Contingent on our result we may extrapolate that although arsenic has been reported as a beneficial metal in human beings in therapeutic range, its toxicity could be associated with psychiatric disorders besides dermatological ailments and organ failure. We endorse a close observation of patients with chronic arsenic poisoning to avert or start early intervention for the disabling mental ailments. We recommend future studies with a control group for further evaluation on the impact of arsenicosis on mental health.

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