



ARSENIC-INDUCED KERATOSIS

Sharmin H¹, Joynal BJ², Islam Sumaiya³, Fatema N⁴, Sultana M⁵, Chowdhury A⁶, Saha KC⁷

Article History:

Received: 11 December, 2025

Accepted: 20th December, 2025

Abstract:

Background with objective: The ground water is the main source of drinking water in Bangladesh which is already contaminated with high concentration of arsenic. Long-term consumption of such water leads to the development of arsenicosis. Melanosis and keratosis of varying degree are the skin manifestation of arsenicosis. Keratosis is usually noticed on the palm of the hands and sole of the feet. The aim of the present study was to observe the keratosis patients due to arsenicosis.

Methodology: This Observational study was carried out among 34 arsenic induced keratosis patients at the Pharmacology department, Bangladesh Medical University (BMU), Dhaka and arsenic affected endemic area Kamalla Union of Muradnagar Upazilla, Cumilla District, Bangladesh from from September 2017 to January 2019. Purposive sampling was done according to availability of the patients. All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science.

Result: The mean (\pm SD) age of the patients was 37.3 ± 5.6 years. The mean amount of arsenic was 146.5 ± 82.0 ($\mu\text{g/L}$) in the tube well water consumed by the patients and Concentration of arsenic in finger nail was 7.5 ± 0.7 $\mu\text{g/g}$. The mean duration of exposure to arsenic contaminated water of the patients was 8.1 ± 2.0 years. The mean duration of the appearance of keratosis was 6.4 ± 2.2 years. The mean size of keratosis nodule was 16.6 ± 5.0 mm^2 . Most of the patients ($n=28$, 82.35%) were exposed to arsenic for about six to ten years and 4 patients (11.76%) were exposed to arsenic for about 11 to 15 years. Most of the patients ($n=17$, 50%) had keratotic nodules for about seven to ten years. Twelve patients (35.29%) had keratotic nodules for about four to six years. In patients with arsenical keratosis, the amount of arsenic in water was within 101- 200 $\mu\text{g/L}$ in 20 patients, 201 - 300 $\mu\text{g/L}$ in five patients, 0 – 100 $\mu\text{g/L}$ in eight patients and 301 – 400 $\mu\text{g/L}$ in remaining one patient.

Conclusion: Patients with chronic arsenicism should have regular long-term examinations because it can cause both cutaneous and systemic neoplasms.

Keywords:

Arsenicosis; Keratosis; Chronic Exposure; Skin lesions; Environmental Health

EWM CJ Vol. 14, No. 2, July 2026: 179-182

Introduction

Exposure to arsenic through drinking water is a major health concern in Bangladesh. Around 35-77 million residents have been continuously exposed to high concentrations of arsenic^{1,2,3}. Arsenicosis results from prolonged ingestion (more than six months) of

arsenic above an acceptable level (>50 $\mu\text{g/L}$), usually manifested by characteristics skin lesions, with or without the involvement of internal organs⁴. The skin manifestations of arsenicosis can be either non-malignant or malignant. The hallmarks of non-malignant manifestations are skin changes

1. Dr. Hazera Sharmin; Assistant Professor, Department of Pharmacology; Uttara Adhunik Medical College, Uttara, Dhaka.

2. Dr. Jakia Binte Joynal, Lecturer, Department of Pharmacology; Uttara Adhunik Medical College, Dhaka, Bangladesh.

3. Dr. Sumaiya Islam, Intern doctor, Shaheed Ziaur Rahman Medical College, Bogura.

4. Dr. Nusrat Fatema, Intern Doctor, Popular Medical College, Dhaka.

5. Dr. Marufa Sultana; Senior Medical Officer, Department of Internal Medicine, Assort Specialized Hospital, Pabna.

6. Dr. Ashis Chowdhury, Assistant professor (c.c), Department of Forensic Medicine, Dhaka National Medical College, Dhaka.

7. Dr. Kartick Chanda shaha, Associate professor (c.c), Department of pharmacology, Dhaka National Medical College.

Address of Correspondence: Dr. Hazera Sharmin; Assistant Professor, Department of Pharmacology; Uttara Adhunik Medical College, Uttara, Dhaka. Phone: 01751926017; E-mail: hazera@gmail.com

characterized by altered pigmentation (melanosis and leucomelanosis) and keratosis. The patchy skin pigmentation bilaterally distributed on the trunk and extremities and looks like raindrops on a dusty road⁵. Keratosis is the thickening of the stratum corneum of the epidermis due to overgrowth of keratin or failure of shedding of the cell from the stratum corneum⁶. Erasmus Wilson first described arsenical keratosis in 1868⁷. The keratosis affects mainly the palms and soles. Arsenical keratosis usually appears as nodules or papules and categorized as mild, moderate and severe. The size of the mild keratotic nodule is less than 2 mm and the grit-like texture can be felt by palpation. Multiple, elevated lesions (>2 to 5 mm in diameter), are categorized as moderate. Moderate nodules are usually bilaterally distributed on the palms and soles. In severe cases, the nodule is >5 mm in diameter with cauliflower appearance⁴. Plantar keratosis is usually associated with debilitating pain and inability to walk⁸. Arsenical keratosis is a precancerous lesion of the skin⁹. When it turns into a malignant form, then there is cracking, fissuring and bleeding¹⁰. Arsenical keratosis has serious implications for arsenicosis patient and their families and treatment of which is remaining unresolved¹¹.

Materials and Methods

This Observational study was carried out among 34 arsenic induced keratosis patients at the Pharmacology department, Bangladesh Medical University (BMU), Dhaka and arsenic affected endemic area Kamalla Union of Muradnagar Upazilla, Cumilla District, Bangladesh from from September 2017 to January 2019. Purposive sampling was done according to availability of the patients. Ethical clearance for the study was obtained from the Institutional Review Board of Bangladesh Medical University. Written informed consent (Bangla version) was taken from every patient. All data were collected through a pre-structured questionnaire. After collection of data, they were checked for errors and then analyzed using the statistical software SPSS 25. The researcher took part in training in the Department of Dermatology, Bangladesh Medical University for two weeks. Identification of arsenical keratosis, psoriasis, eczema and atopic dermatitis were done by the researcher. The total amount of arsenic in the drinking water and nail samples were measured by silver diethyldithiocarbamate method. The size of the

keratotic nodules and skin lesions were measured by the Vernier slide calipers (Tricle brand, China).

Results:

The mean (\pm SD) age of the patients was 37.3 ± 5.6 years. The mean amount of arsenic was 146.5 ± 82.0 ($\mu\text{g/L}$) in the tube well water consumed by the patients and Concentration of arsenic in finger nail was 7.5 ± 0.7 $\mu\text{g/g}$. The mean duration of exposure to arsenic contaminated water of the patients was 8.1 ± 2.0 years. The mean duration of the appearance of keratosis was 6.4 ± 2.2 years. The mean size of keratosis nodule was 16.6 ± 5.0 mm^2 (Table 1).

Table-I
Characteristics of the patients

Parameters	
Gender	
Male (n)	17
Female (n)	17
Age (years)	37.3 ± 5.6
Concentration of arsenic in tube well water ($\mu\text{g/L}$)	146.5 ± 82.0
Concentration of arsenic in finger nail ($\mu\text{g/g}$)	7.5 ± 0.7
Duration of arsenic exposure (years)	8.1 ± 2.0
Duration of keratosis (years)	6.4 ± 2.2
Size of the keratosis nodule (mm^2)	16.6 ± 5.0

*Data are presented as mean \pm SD

Most of the patients (n=28,82.35%) were exposed to arsenic for about six to ten years and 4 patients (11.76%) were exposed to arsenic for about 11 to 15 years (Table 2).

Table-II
Distribution of patients according to the duration of arsenic exposure (n=34)

Duration of exposure of arsenic (year)	No. of patients (%)
1 - 5	2 (5.88%)
6 - 10	28 (82.35%)
11 - 15	4 (11.76%)

Most of the patients (n=17, 50%) had keratotic nodules for about seven to ten years. Twelve patients (35.29%) had keratotic nodules for about four to six years (Table 3).

Table-III

Distribution of patients according to the duration of appearance of the lesions (n=34)

Duration of keratosis (years)	No. of patients (%)
1 - 3	5 (14.70%)
4 - 6	12 (35.29%)
7 - 10	17 (50%)

In patients with arsenical keratosis, the amount of arsenic in water was within 101- 200 µg/ L in 20 patients, 201 - 300 µg/ L in five patients, 0 – 100 µg/ L in eight patients and 301 – 400 µg/ L in remaining one patient (Table 4).

Table-IV

Distribution of patients according to the concentration of arsenic in water (n=34)

Concentration of arsenic in water (µg/ L)	No. of patients (%)
0 - 100	8 (23.52)
101 - 200	20 (58.82%)
201 - 300	5 (14.70%)
301 - 400	1 (2.94%)

Discussion

The mean (\pm SD) age of the arsenical keratosis patients was 37.3 ± 5.6 years. The mean amount of arsenic in the tube well water consumed by the arsenical keratosis patients was 146.5 ± 82.0 µg/L and in the nail sample of the patients was 7.5 ± 0.7 µg/g. The mean duration of exposure to arsenic contaminated water of the arsenical keratosis patients was 8.1 ± 2.0 years. The mean duration of the appearance of arsenical keratosis lesions was 6.4 ± 2.2 years. Near to similar results were obtained in the study conducted by Nargis et. al (2025) in Bangladesh about palmar arsenical keratosis. In their study they stated that mean age of the arsenical keratosis patients was 43.1 ± 11.5 years. The average duration of arsenic exposure was 20.5 ± 7.7 years, with symptoms appearing after approximately 11.1 ± 5.3 years. Arsenic concentrations in drinking water were significantly elevated (mean: 293.1 ± 114.8 µg/l), far exceeding WHO standards. Correspondingly, arsenic levels in finger nails averaged 11.4 ± 2.4 µg/g, confirming prolonged internal exposure¹². Mazumder et. al (2014) conducted a study in West Bengal about socio-demographic profile of arsenicosis patients. They observed that Mean peak arsenic level in drinking

water was 259.53 ± 161.49 µg/l among arsenicosis cases.¹³

Conclusion

Our findings clearly show that extended exposure to tube well water tainted with arsenic, averaging more than five years, causes serious health effects, most notably the development of arsenical keratosis. In order to avoid and manage arsenic-induced health issues in impacted areas, these findings emphasize the critical need for efficient public health measures, such as safe water substitutes, early detection techniques, and community awareness campaigns.

Acknowledgements

The authors are grateful to the entire staff of department of Pharmacology at Bangladesh Medical University, Dhaka during the study period.

Conflict of Interest

Authors declare no conflict of Interest.

Authors Contributions:

Data gathering and idea owner of this study: Hazera Sharmin

Study design: Hazera Sharmin, Marufa sultana, Ashis Chowdhury

Data gathering: Hazera Sharmin, Nusrat Fatema, Kartick Chanda Shaha

Writing and submitting manuscript: Hazera Sharmin, Marufa sultana

Editing and approval of final draft: Hazera Sharmin, Nusrat Fatema

Ethical approval:

IRB, Bangladesh Medical University has approved this study.

References:

1. Smith, A.H., Lingas, E.O. and Rahman, M., 2000. Contamination of drinking-water by arsenic in Bangladesh: A public health emergency. *Bulletin of the World Health Organization*, vol. 78, pp.1093-1103.
2. Argos, M., Kalra, T., Rathouz, P.J., Chen, Y., Pierce, B., Parvez, F., Islam, T., Ahmed, A., Rakibuz-Zaman, M., Hasan, R. and Sarwar, G., 2010. Arsenic exposure from drinking water, and all-cause and chronic-disease mortalities in Bangladesh (HEALS): A prospective cohort study. *The Lancet*, vol. 376, pp. 252-8.
3. Karagas, M.R., 2010. Arsenic-related mortality in Bangladesh. *The Lancet*, vol. 376, p. 213.

4. Caussy, D., 2006. *A field guide: Detection, management and surveillance of arsenicosis in South-East Asia Region* (No. Technical Publication No. 30). WHO Regional Office for South-East Asia.
5. Saha, J.C., Dikshit, A.K., Bandyopadhyay, M. and Saha, K.C., 1999. A review of arsenic poisoning and its effects on human health. *Critical Reviews in Environmental Science and Technology*, vol. 29, pp. 281-313.
6. Wells, R.S. and Kerr, C.B., 1966. The histology of ichthyosis. *The Journal of Investigative Dermatology*, vol. 46, pp. 530-5.
7. McNeer, G., 1934. Arsenical k ratoses and epitheliomas. *Annals of Surgery*, vol. 99, p. 348-349.
8. McLellan, F., 2002. Arsenic contamination affects millions in Bangladesh. *The Lancet*, vol. 359, p. 1127.
9. Neubauer, O., 1947. Arsenical cancer: A review. *British Journal of Cancer*, vol. 1, p.192.
10. Das, N.K. and Sengupta, S.R., 2008. Arsenicosis: Diagnosis and treatment. *Indian Journal of Dermatology, Venereology, and Leprology*, vol. 74, p. 571.
11. Curry, A., Carrin, G., Bartram, J., Yamamura, S., Sims, J., Hueb, J., Sato, Y., Water, S. and World Health Organization, 2000. Towards an assessment of the socioeconomic impact of arsenic poisoning in Bangladesh.
12. Nargis, F.; zaman, M. S.; Rahman, M. M.; Sultana, N.; Methila Sharmin; Salam, T. 2025. Characteristics of Palmar Arsenical Keratosis Patients. *Scholars Journal of Applied Medical Sciences*, vol. 13 (05), pp. 1178–1182. <https://doi.org/10.36347/sjams.2025.v13i05.029>.
13. Mazumder DNG, Majumdar KK, Ghosh A, Ghosh N, Saha C, Nandy A. 2020 , Clinical and Socio Demographic Profile of Arsenicosis Patients in West Bengal. An Observational Study. *Journal of Comprehensive Health*. vol 24, pp. 29–41

 2026 Sharmin H et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-Review History:

The peer review history for this paper can be accessed here: <https://ewmch.com/review/>