Detection,Prevention and Management of Arsenicosis in India

A Field Guide

Directorate General of Health Services

Ministry of Health and Family Welfare

Government of India

FOREWORD

Arsenicosis has been known to be a health problem in some parts of our country. It occurs mainly by drinking Arsenic contaminated ground water and also through contaminated food chain or Industrial pollution for prolonged period. It results in skin manifestations such as Kerotosis, Melanosis and may also affect lungs, liver or lead to various types of cancers. The condition is preventable if measures are taken to provide safe drinking water to the community, promotion of nutrition and also if diagnosed early.

With a view to formulate Guidelines for prevention, control and management of Arsenicosis, an Expert Group was constituted under my Chairmanship. After detailed round of discussions and subsequent exchange of communications, these Guidelines have now been finalized. I am sure that these Guidelines shall be very useful for sensitizing the Health Programme Managers and for training of Medical & Paramedical personnel in the field.

I compliment the officials of the Nutrition & IDD Cell of the Dte. General of Health Services for facilitating in preparation and finalization of these Guidelines.

It is hoped that these Guidelines shall be helpful in prevention and control of Arsenicosis in the affected areas of the country.

Dr. Jagdish Prasad
Director General of Health Services,
Ministry of Health & Family Welfare,
Government of India.

CONTENTS

Detection, Prevention and Management of Arsenicosis in India

1. PREAMBLE

Arsenic occurs naturally in the environment and can be released into water through natural activities such as hydrothermal action & dissolution of rocks. It occurs in both inorganic and organic forms. Inorganic Arsenic compounds (such as those found in water) are highly toxic while organic Arsenic compounds (such as those found in seafood) are less harmful to health. Shift from surface water and shallow open well sources to deep tube well in Arsenic affected areas has also led to Arsenic contamination in some States. Arsenic leaching may also occur from industrial sources or from Arsenic containing insecticides, herbicides or rodenticides.

People are exposed to elevated levels of inorganic Arsenic by drinking and using contaminated water (mostly groundwater) for cooking, irrigation of food crops, industrial processes and smoking tobacco.

Arsenic is also found in groundwater at an average of between 10m and 60m depth and deeper groundwater is generally free from Arsenic.[1]
Arsenic contamination of groundwater may also occur from anthropogenic activities such as mining, over exploitation of ground water etc.In rural areas, more than 85% of drinking water sources are ground water based.

Long-term exposure to inorganic Arsenic can lead to chronic Arsenic poisoning. Skin lesions and skin cancers are the more characteristic features. Presently there is no effective remedy for Arsenic poisoning. The only effective management is through prevention by finding safe alternative sources of drinking water. **Once patients switch to a safe source of drinking water, the skin lesions improve and this improvement may be accelerated by taking High Protein Diet, Vitamin B Complex, Anti-oxidant supplements (e.g. Vitamins A, C, E and Selenium).**

The problem of high Arsenic levels in drinking water has been observed in parts of USA, Canada, Argentina, Chile, Mexico, Hungary and many countries of the South-East Asia Region which contains a natural Arsenic-rich eco-belt formed by Arsenic-laden alluvium or sediments deposited in the Brahmaputra-Gangetic river basins millions of years ago. Countries of South-East Asia that are in this belt include Bangladesh, parts of India, Myanmar and Nepal.

Bureau of Indian Standards (BIS) has specified two types of values for general physico-chemical parameters and toxic elements in drinking water:1) Maximum desirable limit and 2) permissible limit in case of absence of alternative Drinking Water sources.. BIS, specification for drinking water (IS10500:2003) specified both values as 0.05mg/l. However in 2012, BIS reduced the desirable limit of Arsenic from 0.05mg/l to 0.01mg/l while retaining the permissible limit of 0.05mg/l.

In India, groundwater Arsenic contamination was first identified in 1983 and patients were reported from 3 families in a village of 24 Parganas district in West Bengal. Thereafter many more cases were reported from West Bengal and other States like Bihar, Uttar Pradesh, Jharkhand, Assam etc. As per the online Integrated Management Information System (IMIS) of Ministry of Drinking Water and Sanitation , there are about 1800 Arsenic affected rural habitations in the country where 23.98 lakhs people are at risk. IMIS 2015 data indicates that there are 6 Arsenic affected states with regard to ground water sources. State wise no. of habitations :- West Bengal (1218), Assam (290), Bihar (66),Uttar Pradesh (39), Karnataka (9) and Punjab (178). The list of affected districts (subject to change) is shown in Annexure 1.

In order to provide relief to persons affected by the excess Arsenic in water and prevent further exposure, these Guidelines have been prepared for use by the Health Authorities and Programme Managers in the affected areas. These are also to be used for Training of field functionaries such as Medical Officers, Paramedical workers etc.

2. HEALTH IMPACT OF EXPOSURE

The health impact of exposure to Arsenic depends on the dose, the modality and duration of exposure as well as the source and type of Arsenic.

The first visible symptoms caused by exposure to high Arsenic concentrations in drinking water are abnormal black-brown skin pigmentation known as melanosis and symmetrically-distributed, multiple, small elevated lesions of palms and soles known as keratosis. If the Arsenic intake continues, skin de-pigmentation develops resulting in white spots that looks like raindrops (medically described as leukomelanosis). Palms and soles further thicken and painful cracks emerge. These symptoms are described as hyperkeratosis and can lead on to skin cancer (WHO 2001). The disease syndrome caused by chronic Arsenic exposure

is called Arsenicosis and it develops when Arsenic contaminated water is consumed for prolonged period of time. .

It is recognized that Arsenicosis may manifest with or without skin manifestations.However, as skin manifestations are the leading reason for a patient to seek medical care, hence these are used for diagnosis of Arsenicosis based on dermal manifestations, generally Hyperpigmentation and keratosis. Though pigmentation and keratosis are the specific skin lesions characteristics of chronic arsenic toxicity, it also produces various systemic manifestations over and above skin lesions, important ones being chronic lung disease like chronic bronchitis, chronic obstructive pulmonary disease , liver disease like non-cirrhotic portal fibrosis and other diseases like polyneuropathy, peripheral vascular disease, non-pitting oedema of feet/hands[3] (Details in Annex 2).

Trivalent Arsenic is believed to be a carcinogen that induces chromosomal abnormalities including changes in the structure and number of chromosomes and sister chromatid exchanges. The pentavalent Arsenic causes Arsenolysis.The exact molecular mechanism of Arsenic induced carcinogenesis is less understood.

3. DETECTION AND MANAGEMENT OF ARSENICOSIS

In view of the serious consequences of chronic Arsenic toxicity, it is essential to address the situation in a coordinated and focused manner. The Management of Arsenicosis is to be done as follows:-

3.1 Objectives:-

1. To create awareness in the community about preventability, signs and symptoms of Arsenicosis; availability of diagnostic and treatment facilities and measures that can be taken at community level to ensure availability of Arsenic free water etc.
2. Identification of Arsenicosis cases in the community using standard case definitions and algorithms.
3 Capacity building for early diagnosis and management of Arsenicosis.
4 Instituting Linkages with the facilities for treatment, management and establishing a referral system for appropriate management of cases at different levels.
5 Establishing linkages with the existing diagnostic facilities for testing Arsenic in urine, hair and nails.
6 To establish intersectoral linkages for ensuring uninterrupted supply of safe and Arsenic free drinking water.
7 Introducing a mechanism for surveillance of drinking water quality.

3.2 Components

A. Health Education

Health Education is absolutely necessary to change community behavior related to use of water, which in turn will help in prevention of Arsenicosis. Vulnerable populations should also be made aware about common signs and symptoms of Arsenicosis through use of simple, pictorial, context specific IEC material at the community and facility levels.

A combination of learning experiences will have to be designed to help individuals and communities prevent Arsenicosis and facilitate early diagnosis and treatment by increasing their knowledge or influencing their attitudes

Every opportunity – interfaces between health care provider and individuals, groups and communities – e.g. Inter personal communication in clinics, group meetings and mass meetings organized by health and other sectors, should be utilized to disseminate relevant messages.

Traditional folk media, street plays etc. involving the community could also help in awareness generation, motivation and adoption of safe water use practices such as not using water from Hand pumps and Tubewells coloured Red for drinking and cooking purposes..

B. Surveillance of Arsenicosis in the community:-

Survey will be conducted by the trained health workers in the community/ schools in association with district health officials as per surveillance guidelines to identify Arsenicosis at community level. The affected cases to be first referred to the Medical Officers of Primary Health Center (PHC) for further diagnosis and management. After availability of baseline data and after six months of undertaking interventions, a resurvey to be conducted. A mechanism under Integrated Disease Surveillance Programme (IDSP) is to be introduced for surveillance for early case detection and reporting. Cases shall be identified based on two major criteria, namely:-

(a) Presence of pigmentary and keratotic skin lesions, and

(b) Evidence of exposure to elevated levels of Arsenic established by history of intake of Arsenic contaminated water, or by Arsenic concentration in hair or nails.

The Surveillance and Reporting for Arsenicosis under IDSP shall as follows:-

- The terminology such as Suspected case, Probable case and Clinically Confirmed case to be taken as Syndromic, Presumptive and Confirmed case respectively under IDSP.

- Suspected case to be taken as Syndromic case and is classified by the ANM / Health Worker (Male) or other non medical persons. The S form of IDSP would be used (Annexure 3).
- Probable case to be taken as Presumptive case and should be diagnosed by a Medical Officer or a Doctor in the private sector.The P form of IDSP would be used (Annexure 4).
- Clinically confirmed case to be taken as Confirmed case and the criteria are diagnosis by a Dermatologist. Till the time laboratory facilities are easily available at the district level to confirm the presence of Arsenic in the nails and hairs of a patient, the criteria of a Clinically confirmed case may be taken as Confirmed. The L form of IDSP would be used (Annexure 5).

Recording and Reporting

Reports to be compiled at the affected Block/District/State Levels and sent to the next higher level as hard copy and by Email,as per IDSP reporting system.

C. Capacity building at different levels of health care delivery system for early detection and management of Arsenicosis cases.

C.1 Manpower : In order to coordinate the activities, monitor progress and provide feedback provision to be made for following officials:-

National Level:- Nodal Officer (to be designated at the National level).
One Consultant and One DEO.

State Level:-State Nodal Officer (to be designated in each of the affected state) and one DEO.

District level:- District Nodal Officer (to be designated in every affected district) and one DEO.

C.2 Training:

Trainings to be undertaken at the Central, State and District level. Training of Trainers to be organized for State Nodal Officer, District Nodal Officers, at the National Institutions / Head Quarter of any affected State / Medical College by the experts. Besides, Laboratory Technicians of the identified laboratories for estimation of Arsenic in hair, nails and urine will undergo training at any recognized National Reference Laboratory.

Further, trainings, advocacy and sensitization of various categories of health professionals /personnel at different levels of health care facilities will be undertaken at district level. These includes Policy Makers, Health workers, ASHAs, ANMs, Anganwadi Workers, PRIs, VHSC & Teachers.

D. Linkages with existing facilities in the District/ Medical College Hospitals:

Strengthening of existing laboratory diagnostic facilities for Arsenic content in water, Hair & nails, urine in district hospitals/ medical colleges/ Public Health Laboratories for early detection and confirmation of Arsenicosis cases to be done in the affected areas. Sentinel sites must be established in the Medical Colleges.

E. Management of detected Arsenicosis cases including supplementation with vitamins and minerals

Symptomatic treatment of Arsenicosis at the PHC with referrals. A referral mechanism is to be developed to refer the affected person to the trained dermatogist / specialist in the district hospital/state hospital or state medical college for further diagnosis and management .

Patients need to be screened for associated malignancies (esp. skin malignancies) and systemic complication (esp. respiratory, hepatic, neurological, and peripheral vascular affection) which are the major cause of mortality and morbidity; and treated accordingly. Keratolytic agents (e.g., 5-10% salicylic acid or 20% urea) may be given for symptomatic management of keratosis. Supplementation with with high protein diet, B-vitamins and Antioxidants (e.g., Vitamins A, C and E etc.) to be undertaken as these. may reduce the risk of Arsenic-related skin lesions.

F. Coordination Mechanism

National Level:- _ Coordination Committee between Ministry of Health & Family Welfare and the Drinking Water and Sanitation for simultaneous provision of safe water, health education & IEC activities and review of progress made in Arsenic mitigation

State Level:- _ Coordination at State Level shall be similar to the above coordination at National level.

District Level:- District Committees to be constituted to oversee the programme implementation, monitoring the progress on regular basis.

G. Review and Evaluation

Review meetings to be held at National and State levels every year to assess the achievements. Review meetings at the District level to be held quarterly.

4. GUIDELINES

4.1 CASE DEFINITION

Arsenicosis is defined as a chronic health condition arising from prolonged ingestion of Arsenic above the safe dose for at least six months, usually manifested by characteristic skin lesions of melanosis and keratosis, occurring alone or in combination, with or without the involvement of internal organs.

Clinical Criteria _ the first diagnostic criterion requires the presence on physical examination of any of the pigmentary or keratotic skin signs listed earlier. These signs encompass a spectrum of non-cancerous and cancerous cutaneous findings that are well-recognized features of chronic Arsenic ingestion.

Laboratory Criteria _ a reliable history of consuming water with an elevated concentration of Arsenic for at least six months is sufficient to establish exposure. In the absence of adequate information regarding a subject's exposure history, the finding of elevated levels of Arsenic in a subject's hair or nails could offer presumptive evidence of elevated Arsenic exposure. Arsenic testing should be conducted using standardized sample collection methods and acceptable laboratory techniques as elaborated subsequently

Suspected Case _ A "suspected case" is a subject who shows characteristic skin lesions or pigmentary changes or keratosis on first presentation and who has not undergone in-depth medical examination or laboratory testing. The classification of "suspected case" is temporary. It should be reclassified as "probable", "confirmed" or "non-Arsenic" after further clinical examination and or laboratory testing.

Probable Case _ A "probable case" is a suspected case that has undergone further clinical examination and belongs to one of the two categories as below:

Either (a) a suspected case showing melanosis AND bilateral keratosis involving palms and soles OR (b) a suspected case showing unilateral melanosis or keratosis after excluding other skin lesions mimicking Arsenicosis.

Probable cases whose Arsenic tests are subsequently found to be negative maintain the status of probable case.

Clinically Confirmed case _ A “clinically confirmed case” is a “probable case” in whom the presence of other Arsenicosis-simulating skin lesions has been ruled out by differential in-depth skin examination by either a trained dermatologist or an Arsenic expert. The differential features to be used are given in *Annex 2.*

Laboratory Confirmed Case _ A probable case classified on the basis of differential skin diagnosis becomes a “laboratory confirmed case” when subsequent laboratory tests for Arsenic prove to be positive.

Clinically and Laboratory Confirmed Case _ A “clinically and laboratory confirmed case” is a “clinically confirmed case” in whom the Arsenic test is also positive by the criteria recommended.

Non-Arsenic Case _ A “non-Arsenic case” is a “suspected” or “probable” case in which the medical specialist finds that the patient’s skin condition is due to a cause other than Arsenic exposure.

4.2 LABORATORY SUPPORT

Laboratory support provides ancillary information in instances where probable cases cannot be clinically confirmed or in instances or countries where a laboratory diagnosis is required for final confirmation.

4.2.1 TYPES OF SPECIMEN

WATER: Arsenic exposure can be established by testing the water that is currently being consumed.

HAIR AND NAIL: Hair or nails provide circumstantial evidence for history of past exposure within the preceding nine months.

URINE: Both organic and inorganic forms of Arsenic are excreted in the urine which will test positive for Arsenic. Thus, recent exposure to Arsenic can be established from urine samples provided the subjects have not been consuming sea-food in the preceding four days. Alternatively, the chemical form of Arsenic must be differentiated by laboratory methods.

BLOOD: Blood is of no value in establishing chronic Arsenic exposure because of the short half-life of Arsenic in blood.

4.2.2 COLLECTION, STORAGE and TRANSPORTATION

WATER AND URINE: For water and urine samples it is advisable to collect 50 ml of samples. Care must be taken to avoid contamination and prevent speciation changes during sample collection and storage. Plastic containers should be acid washed and traces

of oxidizing agents avoided to preserve the oxidation state of the Arsenic compounds, in instances where speciation is required. The container should also be completely filled to prevent oxidation from the air in the bottle.

Concentrated hydrochloric acid (1 ml of acid to 100 ml of urine) can be used to prevent bacterial growth for urine samples. The samples are stable at room temperature for at least a week and at –20°C for 6 months. For longer periods it is recommended that samples are frozen at -80 C.

Urine and water samples can be transported at room temperature. All specimens must be accompanied by a duly filled request form containing information on the patient's name, referring doctor, clinical diagnosis and an address for sending results. The request form should be packed in a separate plastic bag for protection in the event of specimen leakage.

HAIR AND NAILS: Care should be taken to avoid superficial Arsenic contamination. The hair must be washed with Arsenic-free shampoo and also be free of colouring chemicals containing Arsenic. For a female subject, collect 30 hairs 6 cm. long from the base of the hair, discard the hair beyond 6 cm. For males, collect 60 short hairs from the base. For nails, let them grow for one month then clip every finger and toe nail—this represents 9 months of exposure.

Specimens of hair and nails can be stored at 4°C until tested. Prolonged storage may lead to endogenous fungal growth in some instances. Hair and nails can be transported at room temperature.

4.2.3 ANALYTICAL PROCEDURES

In recent years, the technique of atomic absorption spectrometry (AAS) has become the method of choice due to its selectivity and sensitivity in the detection of Arsenic. Thus, AAS may be considered as the standard reference method ("gold standard") for the evaluation of other test methods. A commonly-used variant of the AAS technique is the highly sensitive hydride generation atomic absorption spectrometric method (HGAAS).

For mass screening under field conditions, or in a situation where no laboratory facilities exist, it is often practical to use a reliable test-kit for testing Arsenic. A number of such test kits are commercially available. However, the validity of these kits in comparison toother test methods must be established. Chemicals such as sulfite and selenium or other impurities can interfere with the performance of some kits and these must be established for each instance.

4.2.4 INTERPRETATION OF LABORATORY RESULTS

WATER:- As per the Bureau of Indian Standards, the desirable limit of Arsenic in water is 0.01 mg/ litre and the permissible limit is 0.05 mg/ litre. [The current WHO guideline value of Arsenic in water is 0.01 mg/L (or 10 µg/L also expressed as 10 part per billion (ppb)]. Thus, any sample containing Arsenic concentration of greater than 0.05 mg/ litre is considered positive in the Indian context.

URINE:- A urine sample showing more than 50 µg / litre may be taken as evidence of recent exposure provided the subject has not consumed sea food during the previous four days.

HAIR AND NAILS:- The value in hair and nails is not known with certainty. However, Arsenic concentration of greater than 1 mg/kg in dry hair and Arsenic concentration of more than 1.5 mg/kg in nail may be considered as indicative of exposure to an unsafe dose of Arsenic within the preceding 11 months.

4.3 MANAGEMENT OF ARSENICOSIS

4.3.1 CESSATION OF EXPOSURE TO DRINKING WATER

As there is no known specific treatment for Arsenicosis, the prudent intervention is to stop consumption of Arsenic-contaminated water. Together with the Public Health Engineering Department, take up appropriate counselling for safe water options and health consequences of consuming Arsenic contaminated water. In general, the water supply option for an area will depend on the availability, quality and development potentials of available alternative water sources in a given area. A single option may not be suitable or affordable for people with different social and economic conditions. Some of the main strategies for safe water should include:

(1) Provision of *safe surface water for drinking & cooking.*

(2) *Rainwater harvesting* has good potential in most parts where there is rainfall. It can be combined with household-based technology with provision for adequate storage tanks. This method is particularly useful in areas where adequate quantity and good quality of surface water sources are limited.

(3) *Treatment of Arsenic contaminated water.* A variety of options are available depending on technologies, cost and acceptability and range from filter units for domestic use, through filter units for community level use to piped supply of Arsenic treated-water.

TECHNOLOGICAL OPTIONS FOR AVAILABILITY OF ARSENIC SAFE WATER IN ARSENIC AFFECTED REGIONS IN INDIA [4]

Based on the experiences in countries like India, China, Bangladesh etc, the following are the major technology options for providing Arsenic safe water in the affected areas:-

- Tapping ground water from alternate arsenic-free aquifers at a higher depth and proper sealing-off of the arsenic bearing aquifer from the same. (>100m).
- Large scale piped water supply for the rural communities by drawing water from the rivers and treating them for removal of pathogenic microbes.
- Conservation and quality up gradation of traditional surface water sources like ponds, dug-wells etc. in the villages. These sources are generally free from Arsenic but grossly contaminated with faecal pollution.
- **Removing Arsenic from the ground water, by using technologies like, adsorption (activated alumina/Iron oxide), co-precipitation (oxidation, coagulation & filtration) or ion exchange. These technologies could be applied in community plants attached to hand pump tube-wells or large dia. tube-wells. Otherwise domestic filters could also be developed on the basis of these technologies.Among the emerging technologies, the Nanotechnology using various kinds of nano materials, developed by the Madras IIT Group, appears to be holding great promise in terms of cost effectiveness and area requirement. Reverse Osmosis process is also being used widely though it consumes huge amount of water.**

Of the various options stated above, Tapping of Arsenic free aquifers is restricted by the absence of clay barrier between the upper arseniferrous aquifer and the deeper Arsenic free aquifers, as has been found in parts of West Bengal, India. In some places, the water bearing aquifer is restricted to 80 to 90 m only, due to presence of hardrock beneath the same. The use of Arsenic Treatment Units fitted to hand pumps, are also facing the problem of sustainability because of the problem of operation & maintenance. A community based system of operation & maintenance, active participation and cost sharing by the people are essential for these to be successful. So far as domestic units are concerned, experience so far suggests low acceptability by the people. Considering that in the long run, use of ground water must be restricted in the Arsenic affected areas, the most appropriate technology option for countries with high annual rainfall and large perennial surface water sources appear to be the surface water based piped water supply systems. However, it is also the most capital intensive among all the options. Sustainability of such systems would be assured by people's participation in the operation and maintenance & cost sharing.

4.3.2 ADMINISTRATION OF NUTRITIONAL SUPPLEMENTS

Though there is no large-scale randomized-controlled double-blinded trial to evaluate the efficacy of supplementation, administration of nutritional supplements like beta carotene, vitamin E and vitamin C have been reported to hasten recovery or averting disease progression. These may be provided to the affected population as an interim measure.

4.3.3 PROVISION OF NON-SPECIFIC THERAPY

Symptomatic treatment for patients with keratosis or keratosis and melanosis includes the application of keratolytic agents. Presently, 5-10% of salicylic acid and 10-20% of urea-based ointment for the treatment of keratotic lesions is the most common prevailing practice.

4.3.4 SECONDARY PREVENTION OF LATENT EFFECTS

Secondary prevention of latent effects should be done through medical surveillance The management of Arsenic-associated cancer patients be done as done for management of cancer patients in general.

4.3.5 PATIENT MANAGEMENT FLOW CHART

The first step, examination of the patient for the presence of non-cancer Arsenic-related skin lesions, may be conducted by trained health care personnel such as medical doctors or other skilled health care providers at the primary care level. These personnel should receive standardized training in the recognition of characteristic Arsenic-related skin lesions. In order to maximize sensitivity of the case detection process at the primary health care level, the personnel are instructed to exercise an inclusive and non-stringent approach when identifying Arsenic related skin lesions.

Patients who are designated “probable cases” should be referred for a second evaluation by a dermatologist or other physicians with specialized expertise in the recognition and diagnosis of Arsenic-related skin lesions and other abnormal conditions of the skin. This evaluation, which should include a complete physical examination and a review of the patient’s medical and exposure history, may be conducted at either the

Primary or Secondary care level. The purpose of the secondary examination is two-fold:-

(a) The criteria outlined earlier *should* be used to perform a differential diagnosis to either confirm or rule out the presence of skin lesions consistent with chronic Arsenic exposure; and

(b) The patient should be evaluated for the presence of other medical conditions potentially related to Arsenic exposure. All patients should be referred, as appropriate, for further evaluation or treatment of any medical conditions detected by the medical specialist. If the

patient's clinical presentation is such that the medical specialist cannot confirm or rule out the presence of characteristic skin lesions, the patient should retain the diagnosis of "suspected/probable case", and be referred for re-evaluation by the medical specialist in 6 to 12 months.

References

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Annexure- 1

State/District- wise Excess Presence of Arsenic in Water as per IMIS of Ministry of Drinking Water and Sanitation (as on 01.4.2015)

Name of the State	Affected District with Arsenic	No of habitations	Remarks
1. West Bengal # (1218)	1. Maldha	65	Also NPPCF
	2. Murshidabad	312	
	3. Nadia	523	
	4. North 24 Paraganas	297	
	5. Hooghly	6	
	6. Bardhaman	15	
2. Assam (290)	1. Nagaon	1	Also NPPCF
	2. Nalbari	6	
	3. Baksha	1	
	4. Barpeta	19	
	5. Cachar	5	
	6. Darrang	24	
	7. Dhubri	22	
	8. Golpara	5	
	9. Golaghat	109	
	10. Jorhat	85	
	11. Kokrajhar	1	
	12. Morigaon	2	
	13. Shivsagar	8	
	14. Sonitpur	2	
3. Bihar (66)	1. Bhagalpur	2	Also NPPCF
	2. Munger	25	Also NPPCF

	3. Begusarai	7	
	4. Darbhanga	5	
	5. Lakhisarai	8	
	6. Patna	3	
	7. Samastipur	12	
	8. Saran	4	
4. Uttar Pradesh (39)	1. Balia	12	
	2. Gorakhpur	8	
	3. Kheri	13	
	4. Sant Kabeer Nagar	6	
5 Karnataka (9)	1. Raichur	3	Also NPPCF
	2. Gadag	3	Also NPPCF
	3. Yadgir	3	
6. Punjab (178)	1. Fazilka	1	
	2. Amritsar	106	
	3. Ferozpur	5	
	4. Gurdaspur	40	
	5. Hoshiarpur	1	
	6. Kapurthala	1	
	7. Roopnagar	6	
	8. Tarantaran	18	
TOTAL		**1800**	

In addition, as per data of Public Health Engineering Deptt.,Govt of West Bengal, 267 habitations of South 24 Parganas and 7 habitations of Haora Districts of the State are Arsenic affected.

Note:-The above number of Arsenic affected habitations is subject to change.

Annexure- 2

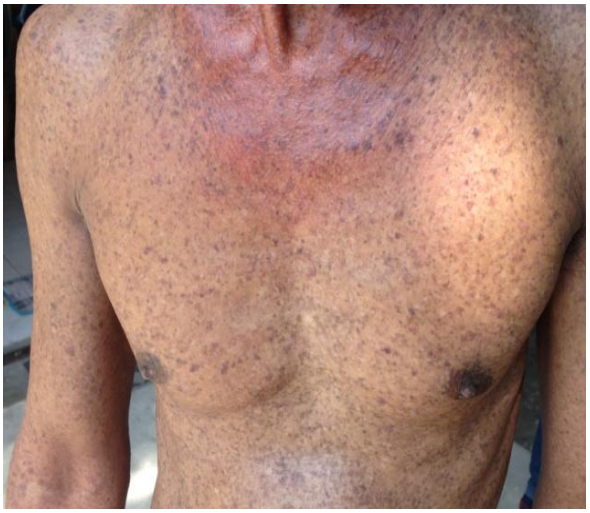
Clinical manifestations of Arsenicosis

2.1 Skin Manifestations: The dermal changes are characterized by increased pigmentation and hardening of the skin, that is a combination of melanosis and keratosis. . The most common sequence is the gradual development of spotted or "raindrop pigmentation", followed by the gradual emergence of hyper-keratotic changes. Both conditions take several years ranging from 6 to 9 years depending on the exposure dose and other host factors. The "raindrop" pattern is particularly pronounced on the trunk and extremities and is symmetrically distributed bilaterally. Mucous membranes such as the undersurface of tongue or buccal mucosa may also be involved. Other patterns include diffused hyper-pigmentation (melanosis); localized or patchy pigmentation and so-called leukodermia or leukomelanosis in which the hypo-pigmented macules take a spotty, white appearance.

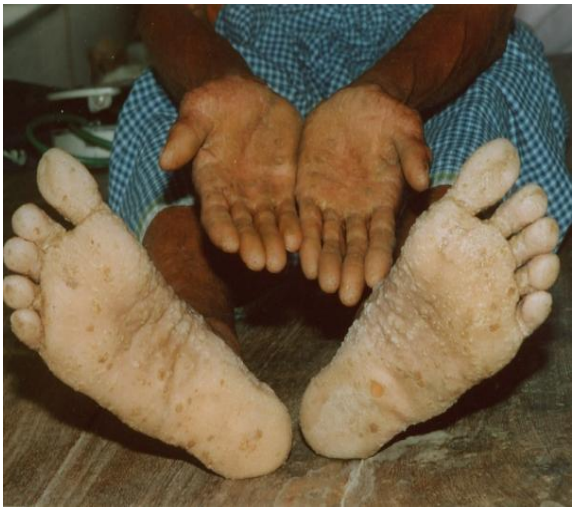
ArsenicArsenical hyper-keratosis predominantly appears on palms and the plantar aspect of the feet, although involvement of the dorsum of the extremities and trunk has also been described. In the early stages, the involved skin might have an indurated, grit-like character that can be best appreciated by palpation; however, the lesions usually advance to form raised, punctuated, 2-4 mm wart-like keratosis that are readily visible. Occasional lesions might be larger (approximately 1 cm) and have a nodular or horny appearance. In severe cases, the hands and soles present with diffused verrucous lesions. Cracks and fissures may be severe in the soles.

MELANOSiS		KERATOSIS
• Fine-freckled or spotted pattern on trunk and extremities (rain-drop pigmentation) • Diffused or generalized hyper pigmentation • Rounded hypo-pigmented or de-pigmented macules on a normal or hyper-pigmented background (leukomelanosis) • Localized or patchy pigmentation generally on the body • Pigmentation of mucous membranes (e.g. oral mucosa),		Characterized by thickening of the skin and appearance of papules or nodules that can both be further sub-categorized as : MILD _ Slight thickening, or minute Papules (less than 2 mm) of palms and soles, often associated with a grit-like texture, that may be primarily detectable by palpation MODERATE _ Multiple, raised keratosis thickening, (>2 to 5 mm), appearing mainly or exclusively in a symmetric distribution on palms and soles SEVERE _ Large discrete or confluent keratotic elevations (> 5

usually in combination with other changes listed above (less common)		mm) on palms and soles, with nodular, wart-like or horny appearance. Less commonly, there may also be involvement of the dorsum of the extremities, and trunk. Diffused thickening of the palms and soles may occur alone or in combination with the keratotic nodules.



Arsenical pigmentation



Arsenical keratosis

[Photos provided by Dr. D N Guha Mazumder]

2.2 Malignancy _ The most common type of malignancy following chronic exposure are skin cancer such as Bowen's disease, squamous cell carcinomas or basal cell carcinomas, although internal malignancies are probably related as well.

BOWEN'S DISEASE

May appear as multiple macules, papule, or plaque (1mm to many cm) in non-sun exposed areas. Usually a scaly, crusted erythematous plaque. They are usually sharply demarcated and seldom indurated (pic overleaf). If the crust is removed, the underlying surface may be red and oozing.

SQUAMOUS CELL & BASAL CELL CARCINOMA

Both these cancers have highly variable clinical appearances, depending in part on the stage of the malignancy. Squamous Cell
Carcinoma is characterized by ulcerated or fungating growth. Basal cell carcinoma is initially characterized by pearly translucent nodules leading to ulcerations

2.3 Differential Dermal Diagnosis

The classic pattern of rain-drop pigmentation is relatively specific for Arsenic, and its occurrence together with palmar-plantar hyperkeratosis is pathognomonic for Arsenicosis. Nonetheless, some of the skin changes associated with Arsenic may appear the same or similar to those encountered in other medical conditions.

There are at least five categories of dermal manifestations mimicking Arsenical dermatosis and include diffused melanosis, spotted melanosis, leukomelanosis, diffused keratosis, and nodular keratosis**.** Clinicians and paramedical personnel practising in primary care settings can be trained to screen patients for the possible presence of characteristic Arsenic-related skin lesions, but a differential diagnosis examination by an experienced dermatologist or other physician with relevant expertise is recommended for confirmation of the diagnosis.

2.4 Other manifestations of chronic Arsenicosis

The most common systemic manifestations include neurological, haematological, gastrointestinal and respiratory complications. Complications of the central and peripheral nervous systems are neuropathy characterized by paresthesias and numbness. Though the incidence of leg pain or intermittent cramp in the leg muscles is not uncommon, dry gangrene is less frequently seen in the Indo-Gangetic Basin.

Haematological complications include leukopenia, anaemia and spleenomegaly. Gastrointestinal complications include symptoms like anorexia, vague abdominal pain or chronic diarrhoea; liver enlargement with or without non-cirrhotic portal fibrosis are also seen. Respiratory complications include chronic cough or bronchitis.

COMMON CONDITIONS TO BE CONSIDERED FORDIFFERENTIAL DIAGNOSIS OF NON-CANCER SKIN LESIONS

CATEGORY	**MAJOR CONDITIONS FOR CONSIDERATION**	**DISTINGUISHING FEATURES**
Diffused Melanosis	Actinic dermatosis Melasma Ashy dermatosis	Found on exposed part of the body Found mainly on face Diffused pigmented macules mainly on trunk
Spotted Melanosis	Pityriasis versicolor	Hyperpigmented macules with fine scale on trunk, face and neck extremities.

	Freckle Lichen planus	Mottled pigmentation on face and trunk increases with sun exposure. Starts with violaceous pruritic papular lesion on trunk and extremities and produces spotty pigmentation on resolution.
Leuco-Melanosis	Idiopathic guttate hypomelanosis Pityriasis versicolor Pityriasis – lichenoides chronica Leprosy	Multiple depigmented macules on trunk and extremities. Hyper and hypo-pigmented macules with scales on trunk, face, neck and extremities. Erythematous papular lesion followed by hypo-pigmented macules Macular hypo-pigmented or erythematous lesions, usually with loss of sensation. There may be involvement of peripheral nerves which are usually thickened and tender.
Diffused keratosis	Psoriasis (palms and soles) Eczema Occupational keratosis Tinea pedis Pitted keratolysis	Diffused keratoderma on palms and soles, with or without scaly psoriatic patches on the other sites. Lichenified lesions with pruritus and occasional oozing. Keratotic lesions corresponding to site of friction. Scaly fissured keratotic lesion, with or without fissures on webs. Multiple pitted (depressed) and keratotic lesions on soles.
Nodular Keratosis	Occupational keratosis Verruca vulgaris Corns/calluses Seborrheic keratosis	Same as above. Multiple verrucous pigmented papules and nodules on trunk, extremities and dorsum of hands and feet. Localized keratotic lesions at the site of frictionDiscrete well-defined pigmented papules and plaques on sun-exposed areas.

Annexure-3

Form S

Reporting Format for Syndromic Surveillance

(To be filled by Health Worker, Village Volunteer, Non-formal Practitioners)

State_____District_____Block_____Year_____

Name of the Health Worker/Volunteer/Practitioner	Name of the Supervisor	Name of the Reporting Unit
ID No./Unique Identifier (To be filled by DSU)	**Reporting week** From dd mm yy To	

	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	Cases							**Deaths**						
	Male			**Female**			**Total**	**Male**			**Female**			**Total**
	< 5 yr	**≥ 5 yr**	**Total**	**< 5 yr**	**≥ 5 yr**	**Total**		**< 5 yr**	**≥ 5 yr**	**Total**	**< 5 yr**	**≥ 5 yr**	**Total**	
1. Fever														
Fever < 7 days														
1 Only Fever														
2 With Rash														
3 With Bleeding														
4 With Daze/Semiconsciousness/ Unconsciousness														
Fever > 7 days														
2. Cough with or without fever														
< 3 weeks														
> 3 weeks														
3. Loose Watery Stools of Less Than 2 Weeks Duration														
With Some/Much Dehydration														
With no Dehydration														
With Blood in Stool														
4. Jaundice cases of Less Than 4 Weeks Duration														
Cases of acute Jaundice														
5. Acute Flacid Paralysis Cases in Less Than 15 Years of Age														
Cases of Acute Flacid Paralysis														
6. Unusual Symptoms Leading to Death or Hospitalization that do not fit into the above.														

Date Signature

Annexure-4

FORM P

(Weekly Reporting Format –IDSP)

Name of Reporting Institution: I.D. No.:

State: District: Block/Town/City:

Officer-in-Charge Name: Signature:

IDSP Reporting Week:- Start Date:- End Date:- Date of Reporting:-

___/___/_____ ___/___/_____ ___/___/_____

Sl.No.	Diseases/Syndromes	No. of cases
1	Acute Diarrhoeal Disease (including acute gastroenteritis)	
2	Bacillary Dysentery	
3	Viral Hepatitis	
4	Enteric Fever	
5	Malaria	
6	Dengue / DHF / DSS	
7	Chikungunya	
8	Acute Encephalitis Syndrome	
9	Meningitis	
10	Measles	
11	Diphtheria	
12	Pertussis	
13	Chicken Pox	
14	Fever of Unknown Origin (PUO)	
15	Acute Respiratory Infection (ARI) / Influenza Like Illness (ILI)	
16	Pneumonia	
17	Leptospirosis	
18	Acute Flaccid Paralysis < 15 Years of Age	
19	Dog bite	
20	Snake bite	
21	Any other State Specific Disease (Specify)	
22	Unusual Syndromes NOT Captured Above (Specify clinical diagnosis)	
23	Total New OPD attendance (Not to be filled up when data collected for indoor cases)	
24	Action taken in brief if unusual increase noticed in cases/deaths for any of the above diseases	

Annexure-5

FORM L

(Weekly Reporting Format – IDSP)

Name of the Laboratory: Institution:

State: District: Block/Town/City:

Officer-in-Charge: Name: Signature:

IDSP Reporting Week:- Start Date:- End Date:- Date of Reporting:-

___/___/_____ ___/___/_____ ___/___/_____

Diseases	No. Samples Tested	No. found Positive	
Dengue / DHF / DSS			
Chikungunya			
JE			
Meningococcal Meningitis			
Typhoid Fever			
Diphtheria			
Cholera			
Shigella Dysentery			
Viral Hepatitis A			
Viral Hepatitis E			
Leptospirosis			
Malaria		PV:	PF:
Other (Specify)			
Other (Specify)			

Line List of Positive Cases (Except Malariacases):

Name	Age (Yrs)	Sex (M/F)	Address: Village/Town	Name of Test Done	Diagnosis (Lab confirmed)