



# A CRITICLE REVIEW ON ARSENIC POISONING

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## ABSTRACT

It has been found that in biological systems heavy metals mainly affect the cellular organelles and on some enzymes which are involved in important metabolisms. After entering into the body it is distributed in a large number of organs including the lungs, liver, kidney and skin. The clinical manifestations of Arsenic poisoning are myriad, and the correct diagnosis depends largely on awareness of the problem. It is very difficult to diagnose early symptoms of arsenicosis because such non-specific symptoms may also be present in many other diseases. Medicine used for remedy of arsenicosis has been found to be unsatisfactory by repeated application and experience. Melanosis may disappear but keratosis is not altered; though it can prevent further complication. Once the complication (malignancy) has developed, using medicine may not prevent it. The incidence of arsenic contamination of ground water used for both irrigation as well as for human consumption or industrial activities has taken the dimension of an epidemiological problem. It has been established that inorganic arsenic is extremely toxic both acute and chronic. Initially it enters into the human body through ingestion, inhalation, or skin absorption. The symptoms and signs of arsenic poisoning may be reduced if the quality of drinking water were improved.

**KEYWORDS :** Arsenic Poisoning, Melanosis, Arsenicosis

## INTRODUCTION

Metallic arsenic is not poisonous as it is insoluble in water and is non-absorbable from the alimentary canal. However, it becomes poisonous when it oxidises if exposed to air. It is believed that some portion of elementary arsenic may undergo oxidation in the alimentary canal under certain conditions and may produce poisonous symptoms. There are

many metal ions among heavy metals are found to be more toxic and dangerous which directly attack on DNA and nuclear proteins which lead to carcinogenesis and cell modulation.<sup>[1-3]</sup> When rubbed on the skin in a finely powdered state, it acts as a poison, as it is capable of being absorbed in the form of an local application may cause necrosis and sloughing. When volatilised by heat, metallic arsenic readily unites with oxygen in the air forming poisonous vapours of arsenic trioxide. The vapour emanating during the smelting of arsenic ores may cause injury to smelters.<sup>[4]</sup> Arsenic is an element that raises much concern from the both environmental and human health standpoints. Elevated concentrations of arsenic in groundwater were first realized in West Bengal, India, and Bangladesh in the 1980s and 1990s with the appearance of skin lesion epidemics in villages, which accessed drinking water by tubewells that tap into the arsenic-enriched aquifers.<sup>[5]</sup> Humans may encounter arsenic in water from wells drilled into arsenic rich ground strata or in water contaminated by industrial or agrochemical waste.

### Poisonous Compounds <sup>[6]</sup>

- 1] Arsenic trioxide (white)
- 2] Arsenic trisulphide(Harital)
- 3]Sodium arsenite
- 4] Copper aceto arsenite (Paris green)
- 5] Copper arsenite (Scheeles green)
- 6] Arsenic acid

### ACUTE POISONING<sup>[7]</sup>

#### Signs and symptoms

- Faintness, Depression
- Severe projectile vomiting
- Pain and irritation of anus
- Diarrhoea - odourless , resembling to rice water stool of cholera
- Oligourea, Albuminuria, Heamaturia & dysuria
- Cramps of muscles, dehydration, convulsions, shock, Coma, finally death

### SUB-ACUTE POISONING

Neuritis, paralysis, CVS disturbances along with GIT manifestation

### CHRONIC POISONING

#### Causes

It results due to,

- As after effect of acute poisoning.
- Consumption of repeated small doses.
- When used as medicine.
- Consuming food or drinks with arsenic.
- In people working in industry, using arsenic.

#### Signs and Symptoms

- **Stage 1 – Stage of Nutritional & Gastrointestinal Disturbance**

-Odema of eyelids and ankles

-Loss of appetite and loss of weight

-Vommiting & colicky pain

-Constipation

-Red and soft gums

-Tongue coated with a white silvery fur

- **Stage 2 Dermatological & Catarrhal changes**

-Rain-drop Appearance

-Milk and Roses complexion

-Aldrich line [Mees line]

-Hyperkeratosis

-Leucomelanosis

-Alopecia

- **Stage 3 Stage of CNS disturbances**

-Polyneuritis

-Athralgia

-Bone marrow Suppression

-Hyperesthesia of Skin

-Muscle tenderness & Cramps

-Impotence

- **Stage 4 (Neuromuscular)**

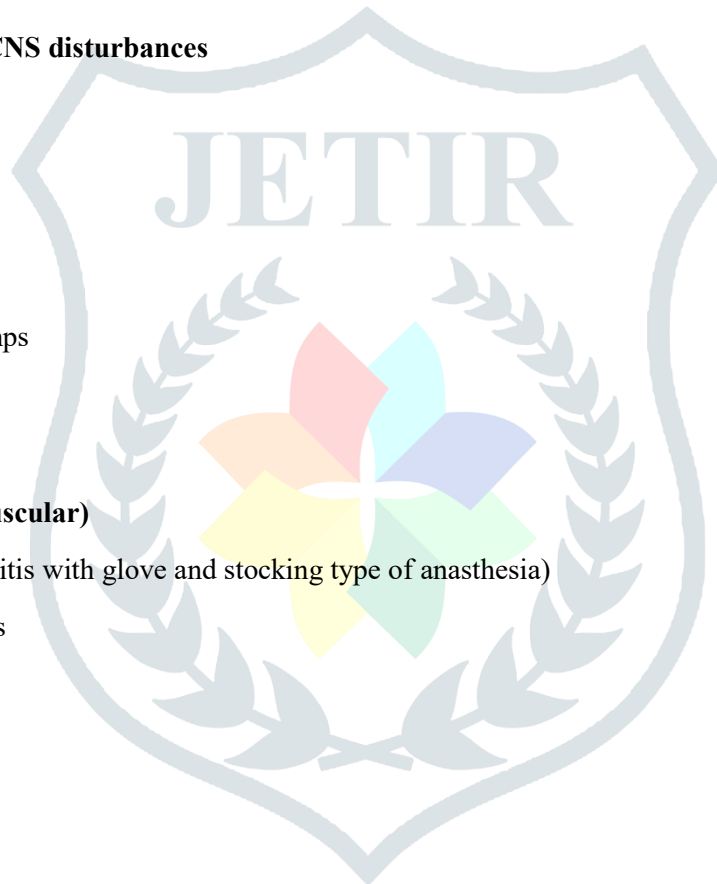
-Neuropathy (Periferal neuritis with glove and stocking type of anasthesia)

-Muscle paralysis/Weakness

-Ataxia

-Wrist Drop / Foot Drop

-Tremors



## CHEMICAL TESTS<sup>[8]</sup>

1. **Reinsch test** – Take 20ml of stomach contents.

-Add 4ml HCl on strip or coil of copper.

-The deposit on copper coil is –Black, if arsenic is present.

2. **Marsh test** –

The sample is reacted with hydrogen to produce arsine gas (if arsenic present) which is ignited and cooled - brownish black film of arsenic formed on porcelain plate kept.

## INVESTIGATIONS<sup>[9]</sup>

ECG: QT prolongation, ST depression, wave flattening.

Serum arsenic: >0.9 μmol/L.

**FATAL DOSE** <sup>[10]</sup>

About 180mg of Arsenious oxide is the average fatal dose.

**FATAL PERIOD** <sup>[11]</sup>

The average fatal period is 12 to 48 hours, though death has frequently occurred within 2-3 hrs. The shortest period is 45 minutes, which indicates the death occurred from shock before the poison was absorbed into the system.

**DIFFERENTIAL DIAGNOSIS** <sup>[12]</sup>

Acute arsenic poisoning has to be diagnosed differently from cholera, and it is possible that mistakes may be made in the diagnosis. When arsenic trioxide is taken, an X-ray of the abdomen shows barium like radio-opaque shadow. The urinary coproporphyrin test be positive. The following are the differentiating points between arsenic and Cholera.

<b>Arsenic Poisoning</b>	<b>Cholera</b>
<ul style="list-style-type: none"> <li>• Circumstantial evidence of poisoning</li> <li>• Vomiting precedes diarrhoea</li> <li>• There is pain in throat</li> <li>• Vomitus initially contains stomach contents, then blood and is later watery</li> <li>• Pain and irritation at anus</li> <li>• Diarrhoea initially contains faecal matter, later blood &amp; is finally watery.</li> <li>• Eyes congested</li> <li>• On X-ray abdomen-barium like radio opaque shadow seen</li> <li>• Chemical analysis confirms the arsenic poisoning</li> </ul>	<ul style="list-style-type: none"> <li>• of usually epidemic</li> <li>• Vomiting follows diarrhoea</li> <li>• Nil</li> <li>• Watery throughout</li> <li>• Nil</li> <li>• Watery throughout</li> <li>• Nil</li> <li>• Nil</li> <li>• Bacteriological examination confirms cholera</li> </ul>

**MANAGEMENT** <sup>[13]</sup>**A) Management of Acute Arsenic Poisoning**

- The patient should be removed from the source of the poison and excretion of arsenic should be promoted through the kidney and the bowels.
- Eliminations -Emetics (Apomorphin Injection).
- Gastric lavage with warm water and milk.
- **Antidote** - Dimercaprol (BAL), a chelating agent is recommended as Antidote.
  - ✓ **BAL** in severe **acute arsenic poisoning** is 3 mg/kg given IM injection in gluteal region:
    - Four hourly for first 2 days,
    - Then Six hourly for next 4 days,
    - Then Twelve hourly for next 6 days,
    - until full recovery.

✓ Dose of BAL in **mild acute arsenic poisoning** is 2.5 mg/kg BW 8 hourly for 2 days, then OD until full recovery.

- **Cathartics**, for example MgSO<sub>4</sub>, castor oil.
- Whole bowel irrigation.

### B) Management of Chronic Arsenic Poisoning

- Remove the patient from source of exposure.
- BAL 6 hourly for 2 to 3 days, then OD daily.
- Vit. B, inj. for peripheral neuritis.

## POST-MORTEM APPEARANCES<sup>[14]</sup>

### External Appearances

- Riger mortis lasts longer than usual.
- Cynosis or Jaundice.
- The body sometimes presents a shrunken appearance due to dehydration.
- The eyeballs are sunken.
- Delayed putrefaction.
- Arsenic favours mummification.

### Internal Appearances

- Cloudy swelling & fatty degeneration of liver, kidney, heart may be present.
- Mucous membrane of Mouth, Pharynx, Oesophagus may show inflammation & ulceration.
- Stomach shows Red Velvety Appearance.
- Sub-endocardial petechial haemorrhages in heart.
- All organ congested, enlarged. Lungs congested with subpleural ecchymoses.

## MEDICOLEGAL IMPORTANCE<sup>[15]</sup>

- Since tasteless and odourless. commonly used for homicide, suicide, as abortifacient, as cattle poison and as stupefying poison. Earlier it was the most common homicidal agent. Even Napoleon was killed using arsenic.
- Pure Arsenic is not soluble in water. Arsenic easily dissolves in tea, coffee, alcohol. Even when given by routes other than oral, it is re-excreted in stomach. It leads to tolerance and addiction -arsenophagia.
- During PM besides routine viscera hair, nails and ends of long bones are preserved as additional viscera. 2-4 weeks after ingestion arsenic is found in hair, nails and skin and after 4-6 weeks in bones.
- A serial analysis of hair and nails gives an idea of successive dosages of arsenic consumed. Hair examination proved the death of Napoleon to be due to chronic Arsenic poisoning.
- In West Bengal, there is adulteration of water with arsenic, hence, chances of chronic poisoning.
- Previously arsenic was used to fair the complexion, as love philter and as aphrodesiac.
- Accidental poisoning may occur, if they chew paints or eat vermin or bait or ant syrup containing arsenic.<sup>[16]</sup>

## DISCUSSION & CONCLUSION

All natural resources are contaminated with high concentration of arsenic which ultimately results major environmental and health problems in the affected areas. It has been concluded from many lab studies that reactive oxygen production and oxidative stress play a vital role in toxicity and carcinogenicity due to Arsenic because these metals show high degree of toxicity and lead to fatal diseases. It has been observed that inorganic form of arsenic is most toxic both acute and chronic. Initially arsenic enters into the body through inhalation, ingestion and distributed in different parts of human body like liver, skin, lungs and kidney. It has been very difficult to detect arsenic toxicity in body parts because it has many similar symptoms in other diseases also. Many chelating agents nowadays have discovered against the toxic effect of arsenic on human bodies like BAL has potential to treat the chronic arsenic toxicity effectively. Long-term exposure to arsenic from drinking-water and food can cause cancer and skin lesions. It has also been associated with cardiovascular disease and diabetes. In utero and early childhood exposure has been

linked to negative impacts on cognitive development and increased deaths in young adults. From this we concluded that Arsenic poisoning causes hazardous effects on human body, so we have to alert from its source of exposure & the most important action in affected communities is the prevention of further exposure to arsenic by provision of a safe water supply.

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