

# Prevention and Ayurveda Management of Lead Poisoning

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## ABSTRACT

**Introduction:-** Lead has been used widely for centuries, the effects of exposure are worldwide. While the effect of industrialization and commercialization are widely and rapidly spreading in the society, the chances of contacts with toxins are also increasing. Exposure to lead can occur by contaminated air, water, dust, food, or consumer products. Children are more at risk for lead poisoning because their smaller bodies are in a continuous state of growth and development. . Lead is a common environmental pollutant. Causes of environmental contamination include industrial use of lead, such as is found in facilities that process lead-acid batteries or produce lead wire or pipes, and metal recycling. Lead is absorbed at a faster rate compared to adults, which causes more physical harm than to older people. In Ayurveda these type of toxins which are accumulated in body described under the concept of Dushi Visha .

**Purpose:-** Atmospheric lead pollution increased dramatically beginning in the 1950s as a result of the widespread use of leaded gasoline. Lead is one of the largest environmental medicine problems in terms of numbers of people exposed and the public health toll it takes. Lead exposure accounts for about 0.2% of all deaths and 0.6% of disability adjusted life years globally.

**Methods:-** Methodology of prevention & management of cumulative toxicity in human beings has been developed by survey study of Ayurveda text books and its concern commentaries , modern text books and research article .

**Result:-**Education is a key component of prevention of lead exposure. According to Ayurveda Nidan parivarjan is the first prevention of disease. American Academy of Pediatrics define lead poisoning as blood lead levels higher than 10 µg/dL Due to long exposure of toxic metabolites in day today life these toxic substance accumulate in the body & produce symptoms like- abnormal growth & development , impaired neuro behavioral function etc. Screening is an important method in preventive

medicine strategies. Sanshodhan Chikitsa (Shunhyadi Gud Panak) which is described by Acharya Charaka removes the toxic metabolites, Sansaman Chikitsa (Dushivishari agad ) neutrise the toxins from the body.

**Conclusion :-** With the help of ayurvedic concept Nidan parivarsan , sanshodhan & sanshaman chikitsa we can eliminate the toxic metabolites from the body & save the living beings from toxic exposure.

## Introduction

Classically, "lead poisoning" or "lead intoxication" has been defined as exposure to high levels of lead typically associated with severe health effects. Lead poisoning may be acute (from intense exposure of short duration) or chronic (from repeat low-level exposure over a prolonged period), but the latter is much more common. Lead is the most important toxic heavy element in the environment. Due to its important physico-chemical properties, its use can be retraced to historical times. . Due to its non-biodegradable nature and continuous use, its concentration accumulates in the environment with increasing hazards. Lead is a highly poisonous metal affecting almost every organ in the body. Of all the organs, the nervous system is the mostly affected target in lead toxicity, both in children and adults. The toxicity in children is however of a greater impact than in adults.

## Possible pathway of lead poisoning

Poisoning due to lead occurs mainly by ingestion of food or water contaminated with lead. However accidental ingestion of contaminated soil, dust or lead based paint may also result in poisoning.

### Domestic exposure

Lead toxicity may be caused through fruits and vegetables contaminated with high lead levels from the soils where they were grown. The soil accumulates lead levels generally from pipes, lead paint and residual emissions from leaded gasoline that was used before the Environment Protection Agency issued the regulation around 1980.

### Occupational exposure

Occupational exposure as the major concern and also the main cause of lead poisoning was reported by Needleman (2004)<sup>1</sup>. The common working facilities that involve lead containing products are radiation shields, ammunition, certain surgical equipment, developing dental X-ray films prior to digital X-rays, fetal monitors, plumbing, circuit boards, jet engines, and ceramic glazes (Patrick, 2006)<sup>2</sup>. All these increase the chances of toxicity with increasing exposure. In addition, many other occupational workers like lead miners and smelters, plumbers and fitters, car mechanics, glass manufacturers, construction workers, battery manufacturers and recyclers, firing range instructors, and plastic manufacturers are at risk for lead exposure. Occupations like welding and manufacture of battery recycling present also a risk for lead exposure (Sanborn *et al.*, 2002)<sup>3</sup>. Parents who are exposed to lead at workplaces generally bring lead dust to their home with clothes or on their skin, thus increasing the chances of exposure in their children (Watts, 2009). The boom of industrialization in the modern world makes use of lead and lead products. Thus due to the industrial use of lead in modern times, the routes by which exposure generally occurs in humans is difficult to trace exactly. Less common sources of incidental or unique lead exposure are numerous: lead-glazed ceramic pottery; stained glass framing; pewter utensils and drinking vessels; older plumbing systems with leaded pipes or lead soldered connections; lead-based painted surfaces undergoing renovation or demolition; imported children's trinkets and toys; lead-containing folk remedies and cosmetics; bullet fragments retained in human tissue (ATSDR, 2007; CDC, 1991)<sup>4</sup>.

### Pathophysiology

Lead has three important biochemical properties that contribute to its toxic effects on humans. **Firstly**, it is an electropositive metal with high affinity for sulfhydryl groups and thus inhibits sulfhydryl dependent enzymes such as 5-aminolaevulinic acid

dehydratase (ALAD) and ferrochelatase which are essential for the synthesis of heme. **Secondly**, divalent lead acts in a manner similar to calcium and competitively inhibits its actions in important areas such as mitochondrial oxidative phosphorylation. In particular, lead impairs the intracellular messenger system normally regulated by calcium and thereby affects endocrine and neuronal function. Lead also changes the vasomotor action of smooth muscle by its effect on Ca ATPase. **Thirdly**, lead can affect the genetic transcription of DNA by interaction with nucleic acid binding proteins with potential consequences for gene regulation. Heavy metals, including lead, create reactive radicals which damage cell structures, including DNA and cell membrane (Kosnett, 2006)<sup>5</sup>. Lead also interferes with the enzymes that help in the synthesis of vitamin D and with enzymes that maintain the integrity of the cell membrane. Lead was also found to interfere with DNA transcription.

### Symptoms of lead poisoning

#### Acute poisoning

In acute poisoning, typical neurological signs are pain, muscle weakness, numbness and tingling, and, rarely, symptoms associated with inflammation of the brain. Abdominal pain, nausea, vomiting, diarrhea, and constipation are other acute symptoms. Lead's effects on the mouth include astringency and a metallic taste. Gastrointestinal problems, such as constipation, diarrhea, poor appetite, or weight loss, are common in acute poisoning. Absorption of large amounts of lead over a short time can cause shock (insufficient fluid in the circulatory system) due to loss of water from the gastrointestinal tract. Hemolysis (the rupture of red blood cells) due to acute poisoning can cause anemia and hemoglobin in the urine. Damage to kidneys can cause changes in urination such as decreased urine output. People who survive acute poisoning often go on to display symptoms of chronic poisoning.

#### Chronic poisoning

Chronic poisoning usually presents with symptoms affecting multiple systems, but is associated with three main types of symptoms: gastrointestinal, neuromuscular, and neurological. Central nervous system and neuromuscular symptoms usually result from intense exposure, while gastrointestinal symptoms usually result from exposure over longer periods. Signs of chronic exposure include loss of short-term memory or concentration, depression, nausea, abdominal pain, loss of coordination, and numbness and tingling in the extremities. Fatigue, problems with sleep, headaches, stupor, slurred

speech, and anemia are also found in chronic lead poisoning. A blue line along the gum with bluish black edging to the teeth, known as a Burton line, is another indication of chronic lead poisoning. Children with chronic poisoning may refuse to play or may have hyperkinetic or aggressive behavior disorders. Visual disturbance may present with gradually progressing blurred vision as a result of central scotoma, caused by toxic optic neuritis.

### Effects on children

Pregnant women who have elevated blood lead levels are at a risk of premature birth or of babies with a low birth weight. Children have been repeatedly reported to be at higher risk for lead poisoning because their bodies are in a state of growth and development (Chisolm & Harrison, 1956)<sup>6</sup>. Moreover, the absorption of lead occurs more quickly in children than in adults. Children, due to their childish behavior, are more prone to ingest and inhale dust contaminated with lead (Landrigan, 2002)<sup>7</sup>.

### Diagnosis

In order to prevent lead poisoning and toxicity, proper diagnosis is a primary and rather important issue. In order to make a proper diagnosis, an inquiry about the possible routes of exposure is a must (Nevin, 2007)<sup>8</sup>. The inquiry should include medical history and determination of clinical signs. The involvement of proper staff, *i.e.* clinical toxicologists and medical specialists, can help in establishing proper diagnosis and treatment.

### Concept of Ayurveda regarding accumulative poisoning:-

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As per the definition any substance which has properties of *visha* and that which is detrimental to the tissue elements on aggravation in favorable condition can be considered as *dushi visha*.

This type of cumulative toxicity of pesticides is already mentioned in *Ayurveda* & described under heading of *Dushi Visha* In *Ayurveda* Cumulative effect of weak poison on human health describes under the heading of *Dushi Visha*. These poisons not eliminated completely & remain as residue in tissues for year & produce

adverse effect after exaggeration which accumulated and cannot be excreted from body completely due to its chronic and cumulative nature or becomes less potent after digestion or counter action of antidotes & stays in the body for a prolong period and vitiating the body slowly is called *Dushi Visha*.

9, 10, 11, 12,13

**General Clinical Features of *Dushi Visha* as per Various Acharya**

Sr.	Feature	<i>Sushru</i> <sup>i</sup>	<i>Charak</i> <sup>ii</sup>	<i>Astang-Sangrah</i> <sup>iii</sup>	<i>Ashtang Hridaya</i> <sup>iv</sup>	<i>Yograt-nakar</i> <sup>v</sup>	<i>Bhavprakash</i> <sup>vi</sup>	<i>Vangsen</i> <sup>vii</sup>
1	Inebriant after Food ( <i>Annamada</i> )	✓	-	-	-	✓	✓	✓
2	Indigestion ( <i>Vipaka</i> )	✓	-	-	-	✓	✓	✓
3	Loss of Taste ( <i>Arochak</i> )	✓	-	-	-	✓	✓	✓
4	Patches & Rashes on Skin ( <i>Mandal-Kotha</i> )	✓	✓	✓	✓	✓	✓	✓
5	Delusion ( <i>Moha</i> )	✓	-	-	-			
6	Wasting of Tissue ( <i>Dhatukshaya</i> )	✓	-	-	-	✓	✓	✓
7	Edema of Feet & Hand ( <i>Pada-Karasya Shoph</i> )	✓	-	-	-	✓	✓	✓
8	Ascites ( <i>Dusyodar</i> )	✓	-	✓	✓			
9	Vomiting ( <i>Chhardi</i> )	✓	-	✓	✓	✓	✓	✓
10	Lose Motion ( <i>Atisar</i> )	✓	-	✓	✓	✓	✓	✓
11	Discoloration of Body ( <i>Vaivarya</i> )	✓	-	✓	✓			

12	Unconsciousness ( <i>Murchha</i> )	✓	-	✓	✓	✓	✓	✓
13	Fever ( <i>Visham Jwar</i> )	✓	-	-	-	✓	✓	✓
14	Profound Thirst ( <i>Trushna</i> )	✓	-	✓		✓	✓	✓
15	Insanity ( <i>Unmad</i> )	✓	-	-	-	-	✓	-
16	Flatulence ( <i>Anaha</i> )	✓	-	-	-	-	✓	-
17	Aspermatogenesi s( <i>ShukraKshaya</i> )	✓	-	-	-	-	✓	-
18	Stammering Speech ( <i>Swara Vikriti</i> )	✓	-	✓	✓	✓	✓	-
19	Bad Smell of Mouth ( <i>Vaigandha Mukh</i> )	✓	-	-	-	✓	-	✓
20	Bad Taste of Mouth ( <i>Vairasya Mukh</i> )	✓	-	-	-	✓	-	✓
21	Giddiness ( <i>Bhram</i> )	✓	-	-	-	✓	-	✓
22	Abnormal Activity ( <i>Vicheshta</i> )	✓	-	-	-	✓	-	✓
23	Dyspnea ( <i>Shwas )</i>	✓	-	✓	✓	✓	✓	✓

### Prevention Methods:-

1. **Education:**-In order to prevent the general population from domestic lead poisoning, it is necessary to educate people about the major sources of lead poisoning. Lead from water pipes coming into homes is one of the major sources (Moore, 1977)<sup>14</sup>.
2. **Construction year:**-It is important to determine the construction year of the house or the dwelling where your child spends a large amount of time (e.g., grandparents or daycare). In housing built before 1978, assume that the paint has lead unless tests show otherwise.
3. **Talk to your state or local health department about testing paint and dust from your home for lead.**
4. **Make sure your child does not have access to peeling paint or chewable surfaces painted with lead-based paint. Create barriers between living/play areas and lead sources.** Until environmental clean-up is completed, you should clean and isolate all sources of lead. Close and lock doors to keep children away from chipping or peeling paint on walls. You can also apply temporary barriers such as contact paper or duct tape, to cover holes in walls or to block children's access to other sources of lead.
5. **Regularly wash children's hands and toys.** Hands and toys can become contaminated from household dust or exterior soil. Both are known lead sources.
6. **Regularly wet-mop floors and wet-wipe window components.** Because household dust is a major source of lead, you should wet-mop floors and wet-wipe horizontal surfaces every 2-3 weeks. Windowsills and wells can contain high levels of leaded dust. They should be kept clean. If feasible, windows should be shut to prevent abrasion of painted surfaces or opened from the top sash.
7. **Take off shoes when entering the house to prevent bringing lead-contaminated soil in from outside.**
8. **Prevent children from playing in bare soil; if possible, provide them with sandboxes.**
9. Avoid using traditional folk medicine and cosmetics that may contain lead;
10. Avoid eating candies imported from Mexico;
11. Avoid using containers, cookware, or tableware to store or cook foods or liquids that are not shown to be lead free;
12. Remove recalled toys and toy jewelry immediately from children.

### Treatment

1. **Removal of the patient from the source of exposure:-** The most important initial aspect of management of lead poisoning is the removal of the patient from the source of exposure. With adults this usually means a change in work or at least in working practice, or the cessation of hobbies that involve lead exposure.
2. **Complete patient History:-** Occupational History & if there is no occupational hazard then sources of lead at home must be eliminated, particularly in the case of children. Isotopic analysis of lead can usefully detect the domestic source of the toxin <sup>15</sup>. Fasting, iron deficiency and low dietary calcium promote lead absorption .
3. **Complete patient Examination**
4. **Laboratory Investigation :-** Blood Lead Level, Zinc protoporphyrin (ZPP) concentration in blood usefully reflects lead exposure over the prior 3 months.
5. **Chelating Agents:-** BAL, EDTA, DMSA

The mainstay of treatment for lead poisoning is the use of chelating agents which form complexes with lead, prevent its binding to cell constituents and, being hydrophilic, are eliminated in the urine.

⌊ The chelating agents used for treatment of lead poisoning are edetate disodium calcium (CaNa<sub>2</sub>EDTA), dimercaprol (BAL), which are injected.

⌊ and succimer (2,3-dimercaptosuccinic acid, DMSA) and d-penicillamine, which are administered orally. The advantages of succimer include its high affinity for lead and suitability for administration by mouth.

⌊ Chelation therapy is used in cases of acute lead poisoning, severe poisoning, and encephalopathy and is considered for people with blood lead levels above 25 µg/dl.

⌊ Chelation therapy is of limited value for cases of chronic exposure to low levels of lead. The most reported adverse side effect for succimer is gastrointestinal disturbances. It is also important to note that chelation therapy only lowers blood lead levels and may not prevent the lead-

Chelating agents can have adverse effects; for example, chelation therapy can lower the body's levels of necessary nutrients like zinc. Chelating agents taken orally can increase the body's absorption of lead through the intestine.

**Ayurvedic Treatment:-** Ayurveda treatment is beneficial for cases of chronic exposure to low level of lead.

**1. Nidan Parivarsan**

- 2. Samshodhan Chikitsa (Purification procedure):-** All the *Acharya* except *Charak* mentioned the Sudation followed by Induced Emesis or Induced Purgation or both able to excrete the *Dushi Visha* from human body by means of purification

**Vaman( Induced Emesis)-** As *Lagenaria Siceraria* is specially indicated for management of poison, own juice or essence root may be benefited to excrete the cumulative pesticides by means of Induced Emesis.

**Virechan (Induced Purgation)-** As *Euphoria* is best & indicated for *Dushi Visha*, milky juice dried in rock salt & mixed with *Triphala* Decoction may be useful to excrete the cumulative pesticides by means of Induced Purgation.

- 3. Sansaman Chikitsa ( Detoxification procedure)-** *Dushivishari Agad* having herb &

mineral has antitoxic effect. It also helps to balance the body essence as *Acharya* mentioned that for complete health, body essence may be balance

- 4. Raktamokshan Chikitsa ( Blood letting procedure)**
- 5. Prativisha (Antidot) – Hemaharitiki + Mishri, Triphala churn**

**Conclusion**

Of all the heavy metal poisonings, lead poisoning appears to be rather prominent. The use of lead has been evidenced from ancient times and its toxicity reports are well documented. Due to its important physico-chemical properties, it has been used all over the world. With the onset on industrialization

from the seventeenth century onwards, its use increased manifold, leading to increased toxicity in humans. Children are at a higher risk, particularly at sites where lead related occupations are nearby their playing grounds. Workers who are occupationally exposed to lead are also at increased risk of lead poisoning. Children of parents who are occupationally exposed to lead should be frequently checked for lead levels in their blood to avoid lead related risks.

**References:-**

1. Needleman H. Lead poisoning. *Annu Rev Med.* 2004;55:209–22. [PubMed]
2. Patrick L. Lead toxicity, a review of the literature. Part 1: Exposure, evaluation, and treatment. *Altern Med Rev.* 2006;11:2–22. [PubMed]
3. Sanborn MD, Abelsohn A, Campbell M, Weir E. Identifying and managing adverse environmental health effects: 3. Lead exposure. *CMAJ.* 2002;166:1287–1292. [PMC free article] [PubMed]
4. Agency for Toxic Substances and Disease Registry (ATSDR) Lead Toxicity: Who Is at Risk of Lead Exposure? Environmental Health and Medicine Education. 2007 U.S. Department of Health and Human Services. Course: WB 1105.
5. Kosnett MJ. Lead. In: Olson K.R, editor. *Poisoning and Drug Overdose.* 5th ed. McGraw Hill Professional; 2006.
6. Chisolm J, Harrison H. The Exposure of Children to Lead. *J Am Acad Pediatrics.* 1956;18:943–958. [PubMed]
7. Landrigan PJ, Schechter CB, Lipton JM, Fahs MC, Schwartz J. Environmental pollutants and disease in American children. *Environ Health Perspect.* 2002;110:721–8. [PMC free article] [PubMed]
8. Nevin R. Understanding international crime trends: the legacy of preschool lead exposure. *Environ Res.* 2007;104:315–336. [PubMed]
9. Sushrit, Sushrit Samhita, Kalpsthana 2/25-26 Hindi Commentary by Kaviraj Ambikadatta Shastri, Sanskrit Sansthan Publication Varanashi, Reprinted in 2007, Page 25
10. Vagbhat, Ashtang Sangraha Uttarsthan 40/44 English Commentary by Prof.K.R. Srikanth Murthy, Chaukhambha Orientalia Publication Varanashi, 1<sup>st</sup> edition in 1997, Page 358.
11. Vagbhat, Astang Hrudaya, Uttarsthan 35/33 English Commentary by Prof.K.R. Srikanth Murthy, Krishnadas Academy

- Publication Varanashi, 1<sup>st</sup> edition in 1995, Page 333
12. Bhavmishra, Bhavprakash Uttarardha, Visha Adhikar 67/37 Hindi Commentary by Shrihari Prasad Pandeyen, Chaukhambha Sanskrit Sansthan Publication Varanashi, 5<sup>th</sup> Edition in 2005, Page 742
  13. Vangsen Samhita (Chikitsasar Sangraha), Visharoga Adhikar 47 Hindi Commentary by Dr.Ramkumar Ray, 1<sup>st</sup> edition, Prachya Publication Varanashi, in 1983, Page 714.
  14. Moore MR. Lead in drinking water in soft water areas--health hazards. Sci Total Environ. 1977;7:109–115. [PubMed]
  15. Campbell MJ, Delves HT. Accurate and precise determination of lead isotope ratios in clinical and environmental samples using inductively coupled plasma source mass spectrometry. J Anal Atom Spectrum. 1989;4:235–236.
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