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“TOXICITY OF HEAVY METALS IN CONTEXT WITH ASHUDDHA BHASMAS AND REVIEW OF ARSENIC”

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ABSTRACT –

The well-known metal mostly used in *Ayurveda* include Hg, As, Ag, Cu, Pb, tin etc. These metals have specific gravity more than 5. Hence these are categories in group of heavy metals. *Bhasmas* are unique *Ayurvedic* metallic preparations with herbal juices and fruits widely used for treatment of variety of chronic ailment. The *Bhasmas* are products of classical alchemy organo metallic compounds of certain metals and gems in a very fine powdered form mostly oxides made in elaborate incineration processes perfected several centuries ago. Hence importance of classical *Bhasmas Pareeksha* like *Rekhapurnatwa*, *Nishchandratawa* etc. is justified. Improper incineration gives *Ashuddha Bhasma* which contains toxicity and due to which complications arises. A comparative similar thing could be observed between heavy metals and *Ashuddha Bhasmas*. The arsenical compounds are intentionally added to the *Ayurvedic* formulation as main active ingredients or as axillary agent to assist the efficacy of herbal drugs. So review of arsenic discussed here.

Key words – Toxicity, heavy metal, *Ashuddha Bhasma*, Arsenic.

INTRODUCTION:-

The Pharmacological Section of *Ayurvedic* system of medicine recognizes 3 major sources of medicine, those of herbal origin, mineral origin (eg. salts, metals like gold, copper, silver) and animal origin (eg. Milk, honey etc.). Although *Kashthaushadhi* and *Rasaushadi* are two main groups of medicine, the former is devoid of any metals and minerals and is purely herbal product, while the latter can be considered of metals and minerals in the form of *Bhasmas* (incinerated metals and minerals etc.) The well-known metal mostly used in *Ayurveda* include Hg, Au, Ag, Cu, As, lead, tin, etc. These metals have specific gravity more than 5, hence these are categorized in group of heavy metal. *Bhasmas* are unique *Ayurvedic* metallic preparation with herbal juices widely used for treatments of diseases.¹

The *Bhasmas* are products of classical alchemy, organic – metallic compounds of certain metal and gems in a very fine powdered form, mostly oxides, made in elaborate incineration processes perfected several centuries ago. Now a day's some people who are unaware of the pharmaceutical processing of *Rasaushadis* are in doubt about their toxicity.

Recent articles pertaining to the alarming level of heavy metals, especially Pb, Hg &

As in *Ayurvedic* formulations have created a lot of controversy regarding the safety and efficacy of *Ayurvedic* formulations. In the same context, lead, Hg & As have been detected in a substantial proportion of Indian manufactured traditional *Ayurvedic* medicines are unknown, hence an attempt was made to study comparative things or the facts of heavy metal poisoning & *Ashuddha Bhasmas* *Sevan Doshas*. Arsenic is a naturally occurring element that is widely distributed on earth's crust. It is classified chemically as a metalloid, having both properties of metal and nonmetal, however it is frequently referred as metal. The arsenical compounds are intentionally added to the *Ayurvedic* formulations as main active ingredients or as auxiliary agents to assist the efficacy of herbal drugs. Many toxic metals are used in *Ayurveda* after *Shodhana* purification and *Marana* calcination. It is a process to convert inorganic materials to organic compounds for better absorption, assimilation, reduce toxicity and to enhance the medicinal properties.

AIM:

Conceptual study of Toxicity of metals in context with *Ashuddha Bhasmas* *sevan dosha* and review of Arsenic.

OBJECTIVES:

- 1) To review modern concept of Toxicity of metals.
- 2) To review *Ashuddha Bhasama sevan dosha*.
- 3) To review of Arsenic

	Manganese ,
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Methodology:

Toxicity:

The Branch of science which deals with the study of poisons in references to their source , character properties , mechanism of action, sign / symptoms, lethal dose , cause of death ,Rx , detection & estimation & postmortem findings. Toxicity is the degree to which substance can damage an organism. This can affect a whole organism or structure like cell (cytotoxicity) or an organ (Hepatotoxicity)^{2,3}.

a) Classification based an Action⁴

- Corrosives
- Irritants
- Neurotoxic
- Cardiac
- Respiratory
- Miscellaneous.

*** Table no. 1- Irritants toxicity**

Non Metals	Metals
Phosphorous Boron, Fluorine ,Chlorine, Bromine, Iodine	Arsenic , Lead , Mercury , Copper , Ferrous , Zinc , Magnesium ,

Heavy metals

These are essentially those chemical elements that have a specific gravity. Which is five times that of water. These are mast often found to be responsible for harmful damage to humans in cases leading to environmental pollution from various sources are Hg ,As, Pb, Cd, thallium. Heavy metal toxicity refers to the excessive buildup of heavy material in the body. Since body cannot degrade them, they gate accumulated in a body tissues and interfere in the healthy functioning of system and may results in disease like a neurological, degenerative processes, Parkinsonism disease muscular dystrophy, multiple sclerosis etc. Toxicity of metals are listed here according to WHO the metals of most immediate concern internationally are aluminum, chromium, manganese, iron, cobalt, copper, cadmium, mercury, lead , arsenic (WHO 1984). Out of these 106 identified elements, 80 of them are called metals. Metals are divided in two groups that are essential and non-essential. Essential are used for survival and non-essential are toxics.^{5,6}

Factors influencing toxicity

- 1) Path of administration (skin, inhaled, ingested, injected).

- 2) Time of exposure.
- 3) The no. of exposure (single dose or multiple doses).
- 4) The physical form of toxin (Solid, liquid, gas).
- 5) The genetic makeup of an individual.
- 6) Individual’s overall health and many others.

Based on a time of an exposure it can be-

- A) Acute exposure** – A single exposure to a toxic substance which may result in severe biological harm or death.
- B) Chronic exposure** – Continuous exposure to toxin over an extended period of time; often measured in months of years.

Table no. 2 – Metals and it’s Acute and Chronic toxicity

Metals ⁷	Compounds	Acute	Chronic
Mercury⁸	Mercuric chloride (Corrosive sublimate), Mercuric cyanide, Mercurous oxide (Ras Kapoor), Mercuric oxide (Sipichand), Mercuric nitrate, Mercuric Sulphate, Mercuric	Pain and feeling of constriction in mouth and upper GIT, fatigue, depression, headache, vomiting, profuse	Pulmonary edema, pneumonia, ataxia, arthralgia, fibrosis, delirium, polyneuropathy, sensory impairments.

	methide, Mercuric sulphide (China sindur)	bloody diarrhoea, convulsion.	
Copper⁹	Copper sulphides, Copper carbonates, Copper oxide	salivation, Vomiting, Burning pain in upper GIT, thirst, nausea, diarrhoea, hematuria, albuminuria, jaundice, muscular cramp convulsions.	Green purple line on the gum, Nausea, giddiness, headache, colicky pain, conjunctivitis, laryngitis, bronchitis, nephrotoxicity, neuritis, dermatitis, anemia
Gold	Au with Tellurium as the minerals calaverite, krennerite, nagyagite, petzite & sylvanite, Bismuthide maldonite (Au ₂ Bi) Antimonide aurostibite (AuSb ₂) Auricupride (Cu ₃ Au) Novodnepri	Nausea, giddiness, headache, colicky pain, conjunctivitis, dermatitis, pruritus, urticarial etc.	Generalized continuous fine vibrating muscles movements, bone marrow depression in stomach and intestinal bleeding

	te (AuPb ₃) Weishanite ((Au, Ag) ₃ Hg ₂)				chloride Lead chromate – chrome yellow Lead sulphide- surma Tetra – itthaial lead		
Arsenic ¹⁰	Arsenic trioxide – Sankhya Arsenic trisulphide- Harital Arsenic bisulphide- Realgar Potassium arsenite, Aecenic acid Sodium arsenite Copper aecenit Copper asito arcenite	Headache, drowsiness, confusion, seizures, peripheral neuropathy, demyelination, edema, vomiting, pain, fever, diarrhea, hemolysis, anemia, hypotension.	Weakness, muscle aches, chills, fever, hyperkeratosis, hyperpigmentation, polyneuritis,		Silver Agrentite (Ag ₂ S), Cerargyrite (AgCl) Polybasite (Ag ₁₆ Sb ₂ S ₁₁), Proustite (Ag ₃ AsS ₃), Pyrargyrite (Ag ₃ SbS ₃)	Gastrointestinal, Renal, Neurological symptoms, Headaches, Irritability,	Gray discoloration of skin, hair and internal organs.
				Tin Cassiterite (SnO ₂), Stannite, Teallite Cylindrite, Franckeite, Canfieldite	Psychosis, Stupor, Coma and Convulsions these common symptoms will be manifested	Damage nervous system, psychomotor disturbances, convulsions,	Hallucination and psychotic behavior.
Lead ¹¹	Lead tetroxide- indoor Lead acetate-salt of Saturn Lead subacetate, Lead iodide Lead carbonate- safeda Lead nitrate, Lead bromide Lead sulphate, Lead	Vomiting, colic pain, constipation, weakness, anemia, wrist drop, kidney disease.	Hypochromic anemia, lead palsy, encephalopathy, level of lead in blood elevation of free erythrocyte, retinal steeping sterility, hair alopecia.		Zinc Zinc sulphide (ZnS) Zinc oxide (ZnO) Zinc carbonate (ZnCO ₃) Zinc silicate		Metal fume disease or liver dysfunction.

* Table no. 3 –Ashuddhabhasma janya vikara and Apakwabhasma janya vikara

<i>Bhasma sevana</i>	<i>Compounds</i>	<i>Ashuddha bhasma janya vikara.</i>	<i>Apakwabhasma janya vikara.</i>	<i>Maksika</i>			
<i>Parada</i> ¹³	Mercuric chloride (Corrosive sublimate) Mercurous oxide (Ras Kapoor) Mercuric oxide (Sipichand) Mercuric cyanide, Mercuric methide Mercuric nitrate Mercuric sulphate, Mercuric sulphide (China sindur)	<i>Bhumija-Kushtha Girija-Jadyata Jalaja-Vataroga Nagaja-Unmade Vangaja-Mahashul aroga Tamra-Daha Loha-Kantaroga.</i>			Chalcopyrite (Swarn) - CuFeS ₂ Iron Pyrite (Rajata) - FeS ₂	<i>Andhatwa Kushtha roga, Ksaya roga, Krimi roga, Mandagni, Nirbalta, Gandamala, Vrana, Gatraruka</i>	<i>Aneka prakara kushta, Mrityu.</i>
				<i>Shilajatu</i>	Gomutragandhi – Blackbitumen Karpurgandhi – Potassium nitrate	<i>Daha, murcha, bhrma, rakta pitta, kshaya, agnimandya & vibhanda</i>	
				<i>Tuttha</i>	Copper sulphate - CuSO ₄	<i>Vaman, Bhrama, Garavisaghna, Vishaghna</i>	
				<i>Rasaka</i>	Zinc oxide – ZnO	<i>Bhrama, Vami</i>	
				<i>Gandhaka</i>	Copper Pyrite, Iron Pyrite, Copper Sulphate, Ferrous Sulphate, Galena (Nilanjana), Galena (Nilanjana), Zinc Sulphate (Yashada), Antimony Sulphide (Srotonjan)	<i>Mandagani, Ksudra kushta, Kasa (cough), Swasa (Dyspnoea), Wild fire, Dadruoga (Skin disease), Ama Dosha</i>	<i>Kushta, Jwara, Bhrama, Pittaroga, Rupa, Veerya balanasha, tapa, raktavikriti</i>
<i>Abhrak</i>	Biotite - Black mica, Lepidolite – Ruby mica Muscovite – White mica (Potash) Phlogopite – Magnesium mica Paragonite – White mica	<i>Kushtha, Ksaya Roga, Panduroga, Sotha, Pain in cardiac region & flanks, loss of appetite, Guru for digestion.</i>	<i>Poison, Vajra, Sastra agni Prmeha Roga, Chandrika Yukta Bhasma se mrityu.</i>				

	a), Orpiment (Haratala), Realgar (Manasila) , Cinnabar - Hingula					, <i>Bhramas</i>		
Harit ala	Arsenic trisulfide As_2S_3	<i>Ayunashta</i> , <i>Mrityu</i> , <i>kapha</i> <i>roga</i> , <i>Vata</i> <i>roga</i> , <i>jwara</i> , <i>Daha</i> , <i>Sphota</i> , <i>Snaayu</i> <i>sankocha</i> / <i>Anga</i> <i>sankocha</i> , <i>Kushta</i> , <i>Rakta</i> <i>dushti</i> , <i>Kshoba</i> , <i>Kampa</i> , <i>Toda</i>	<i>Vata</i> <i>kapha</i> <i>prakop</i> <i>a</i> , <i>kushta</i> , <i>Tapa</i> , <i>Anga</i> <i>Sankoc</i> <i>ha</i> , <i>Sruja</i>		Swar na	Au with Tellurium as the minerals calaverite, krennerite, nagyagite, petzite & sylvanite, Bismuthid e maldonite (Au_2Bi) Antimoni de aurostibite ($AuSb_2$) Auricuprid e (Cu_3Au) Novodnep rite ($AuPb_3$) Weishanit e ((Au, Ag) $_3Hg_2$)	<i>Bala</i> <i>veeryanas</i> <i>ha</i> , <i>Dukha</i> , <i>Giri</i> <i>bhava</i> , <i>Roga</i> <i>samudaya</i> , <i>Asoukyey</i> <i>a</i> , <i>Marana</i>	<i>Asouky</i> <i>eya</i> <i>veerya</i> <i>bala</i> <i>hani</i>
Mana hshil a	Arsenicdis ulfide As_2S_2	<i>Ashmari</i> , <i>Hridroga</i> <i>Shareera</i> & <i>twacha</i> <i>sundarta</i> <i>nashta</i> , <i>Balhani</i> <i>Mandagni</i> , <i>Malaband</i> <i>ha</i> , <i>Mutra</i> <i>roga</i> / <i>mutra</i> <i>krichra</i>			Rajat a	Mukta rajata (Native silver), Pyrargyrit e(Ag_3SbS_3) Khanija or Yougika rajata Agrentite (Ag_2S), Polybasite ($Ag_{16}Sb_2S_{11}$) Cerargyrit e ($AgCl$), Proustite (Ag_3AsS_3)	<i>Pandu</i> , <i>kandu</i> , <i>Galagrah</i> <i>a</i> , <i>Malaband</i> <i>ha</i> , <i>Veeryanas</i> <i>ha</i> , <i>balahaani</i> , <i>Shiroruja</i> , <i>Veerya</i> <i>nasha</i> , <i>Nanaroga</i> <i>utpanna</i> , <i>Tapa</i> , <i>Tan</i> <i>usada</i>	<i>Ayu</i> <i>veerya</i> <i>bala</i> <i>bala</i> , <i>T</i> <i>apa</i> , <i>vidband</i> <i>ha</i> , <i>Rogakri</i> <i>t</i>
Hing ula	Sulphide of Hg red in colour HgS (Hg86.2%, S 13.5%)	<i>Ksheena</i> , <i>Klama</i> <i>Klaibya</i> , <i>Moha</i> , <i>Prameha</i> <i>roga</i> , <i>Andhatwa</i>			Lauh a	Munda loha – cast	<i>Shandhat</i> <i>wa</i> ,	<i>Jeevaha</i> <i>ra</i>

	iron Tikshna loha – Wrought Kanta - Magnetic	<i>Kushtha, Mrityu, Hridroga, Shula, Ashmiri</i>	<i>madaka ra, Dehash ula, Shareer a tanuta, Daruna hridi ruja, Ayu bala kanta nasha</i>		Canfieldite	<i>a, Balanash a, Kampa, Kilasa, shula, Baghanda ra, Visha, RaktaVika ra, Kshaya, Kaphajwa ra, Ashmari, Vidradi, Mushkaro ga, Jadya, Mahadah a, Veeryanas ha, Murcha.</i>	<i>Prameh a, Anilasa da, shota, Bhagan dara, Apache, Vaatrak ta, Balaha ni</i>	
Naga	Galena(Pb S) Lead Carbonate PbCO ₃ Lead sulphate PbSO ₄ Lead Chloride PbClF Lead oxide PbO	<i>Kushta, Gulma, Aruchi , Kshaya, Kapharog a, Rakta vikara, Pandu, Mutrakric hra, Jwara, Shula, Kamala, Prameha, Kampa , Kilasa, visha, Vatashop a, Vrdradi, Mushka roga, Jadya, Mahadah a, Veeryanas ha, Murcha.</i>	<i>Kushta, Gulma Atikasht a, Pandu, Prameh a, Anilasa da, shota, Bhagan dara.</i>		Yash ada	Zinc sulphide (ZnS) Zinc oxide (ZnO) Zinc carbonate (ZnCO ₃) Zinc silicate	<i>Prameha, Ajeerna, Vatavyad hi, Vami, Bhrama</i>	<i>Prameh a, Ajeerna , Vatavya dhi, Vami, Bhrama</i>
					Vajra	<i>Kushta, Parshwa shula, Pandu, Shareera bharipan, Tapa, Jadya, kilasa, Daha, Guruta</i>	<i>Pandu, Kushta, kilasa, Daha, Guruta.</i>	
Vang a	Cassiterite (SnO ₂) Stannite, Cylindrite, Franckeite,	<i>Kushta, Gulma, Pandu, Prameha, Vatarakht</i>	<i>Kushta, Gulma Atikasht a, Pandu,</i>		Tank ana	White colour Blue colour	<i>Vanti, Bhranti</i>	<i>Vanti.</i>

Review Of Arsenic:

Arsenic Form-Arsenic is a naturally occurring element that is widely distributed on earth crust. It is classified chemically as a metalloid having both properties of metal and nonmetal however it is frequently referred as metal. Arsenic is colorless odorless tasteless on irritating gas that cause rapid and unique destruction.

Arsenic compound¹⁴ –

- 1) Arsenic – Metallic arsenic – As
- 2) Arsenic acid- (4- aminophenyl)-
 $C_6H_8AsNO_3$
- 3) Arsenic Pentoxide- Arsenic oxide –
 As_2O_5
- 4) Arsenic sulfide- Arsenic sulfide –
 As_2S_3
- 5) Arsenic trichloride -Arsenic chloride-
 $AsCl_3$
- 6) Aesenobetaine- Arsonium carbxy
methy trimethyl hydroxide, inner salt,
2-trimethylarsonioacetate $C_5H_{11}AsO_2$
- 7) Calcium arsenate- Arsenic acid
 (H_3AsO_4) - $(AsO_4)_2.3Ca$. Calcium
salt(2:3)
- 8) Dimethylarsenic acid- Cacodylic acid
– $C_2H_7AsO_2$
- 9) Lead arsenate- Arsenic acid (H_3AsO_4)
Pb
- 10) Methanearsonic acid, disodium salt –
Arsonic acid, methyldisodium salt
 $CH_3AsO_3 2Na$

- 11) Methanearsonic acid, monosodium salt
– Arsenic acid – Methyl monosodium
salt – CH_4AsO_3Na
- 12) Potassium arsenate –Arsenic acid
 (H_3AsO_4) - Monopotassium Salt-
 AsO_2K
- 13) Sodium arsenate- Arsenic acid
 (H_3AsO_4) ,Na monododium salt
- 14) Sodium arsenite –Arsenous acid ,
sodium salt $AsO_2 Na$
- 15) Sodium cacodylate – Arsinic acid –
dimethyl- sodium salt – $C_2H_6AsO_2.Na$

Fate of arsenic drug¹⁵ - The primary routes of arsenic entry into the body are ingestion and inhalation dermal absorption also occur but to lesser extent. Arsenic undergoes biomethylation in the liver. Approximately 70% of As is excreted, mainly in urine. Most of single low level dose is excreted within a few days after ingestion.

Fate of Drug

- 1) **Gastrointestinal drugs tract-**
Trivalent Arsenic Compounds
approximately 95% of ingested dose is
absorbed form
- 2) **Lungs**
- 3) **Dermal-** mostly (Arsenic trioxide).
Approximately within 60% to 90%.
Fine particles are deposited more
deeply in the respiratory tract

4) Skin- Generally negligible, either arsenic trichloride or arsenic acid was splashed on workers skin in occupational accident

Distribution-Absorption by lungs\gastrointestinal tract widely distributed by the blood thought out the body. Most tissues rapidly clear As except for skin hair and nails. 2-4 weeks after exposure ceases most of the arsenic remaining in the body is formed is Krratin rich tissues such as hair nails skin and bone teeth. Metabolism Arsenic absorbed into blood stream at cellular level.1) by red blood cell.2) white blood cell.3) and other cells that reduces arsenate to arsenite Reduction of arsenate to arsenite (As111) is needed before methylation can occur . This reaction requires glutathione (GHS). Arsenite methylated in the liver Methylation has been considered the main route of arsenic detoxification but moe recently thee has been a growing body of literature supporting other detoxification mechanisms. For example a no. of animal species lack arsenic. Methylation and excrete inorganic arsenic detoxification mechanisms such as 1) antioxidant defenses 2) resistance to apoptosis 3) Transport there have also been studies of arsenic metabolism suggesting that

methylation of inorganic arsenic may be a toxification rather than a detoxification pathway and that trivalent methylated arsenic metabolites particularly mono methyarsonous acid (MMA111) and methyl arsious acid (DMA111) are unusually capable of irritating with cellular targets such as protein and DNA. Methylation efficiency in humans appears to decreases at high arsenic doses. Patterns of methylated arsenic species in urine are similar between siblings which suggests that arsenic and parents which suggests that arsenic methylation is genetically linked . When the methylation capacity of the liver is exceeded exposure to excess levels of inorganic arsenic results in increased reduction of arsenic in soft tissues.

Excretion- Arsenic is excreted in the urine .Humans excrete a mix of inorganic, monomethylated and dimethylated forms of arsenic . The pentavalent metabolites MMA V and DMA V are less toxic than arsenite or arsenate. About 50% of excreted arsenic in human urine is dimethylated and25% is monomehtylated reminder being inorganic. According to urinary arsenic data from the National Health and Nutrition Examination Survey 2003-2004, as urinary levels of total arsenic increases

and at lower urinary total arsenic levels, the predominant form is inorganic. Other less important routes of elimination of inorganic arsenic include feces, hair, nails, skin desquamation and sweat.

Poisoning of arsenic¹⁶–

1) Acute poisoning –

a) signs and symptoms

- . Faintness depression,
- . Nausea, burning pain in upper GIT, salivation, thirst.
- . Severe projectile vomiting – vomitus initially contains stomach contents later blood and finally it is watery colour of vomitus depends upon the colour of the salt.
- . Pain and irritation of the anus.
- . Diarrhea – foul smelling, initially contains faecal matter, later blood and finally is odourless, Colorless, ricewater stool of cholera.
- . Oliguria, Albuminuria, hematuria and dysuria.
- . Cramps of muscles, convulsion, dehydration, shock, coma, and finally death.

b) Inhalation of fumes- cough, frothy sputum, breathlessness, cyanosis, pulmonary odema, congetion of eyes and ulceration of cornea.

c) With large doses- Sudden death due to shock or mainly narcotic manifestations

giddiness, pain in muscles, delirium, coma and death

2) Sub acute poisoning- Neuritis, paralysis and CVS disturbances, along with GIT manifestation. Also locked jaw, insanity, increased temperature, loss of speech and memory, hemolysis, haemoglobinuria, jaundice, hepatomegaly and aneamia.

3) Chronic poisoning-

a) Stage of nutritional and gastrointestinal disturbances-

weakness loss of weight, loss of appetite, abdominal pain, constipation, red appetite, abdominal pain, constipation, red and soft gums and increased temperature.

b) Stage of catarrhal changes- Increased secretion from larynx, bronchi, hoarseness of voice, congested eyes, photophobia, running nose, cough with expectoration.

c) Stage of skin rashes- Brown, pin point pigmentation of the skin mainly covered parts known as Rain drop appearance' chronic ingestion causes vasodilation and the milk and roses complexion, nails become brittle and have linear pigmentation. Transverse white Mess lines appears on finger nails after about 15 days of exposure, indicating periods of arrested growth,

Hair becomes dry pigmented and may fall of, anaemia, leukopaenia and thrombocytopenia are common.

d) Stage of CNS disturbances-

Headache, tingling and numbness, muscle pain, bone marrow depression and heart involvement.

Fatal dose – 180-200 mg . trivalent are more toxic.

Fatal period- In narcotic form – sudden death or death after 2-3 hrs. In gastrointestinal form 12-48 hours

Treatment-

Use of emetics, gastric lavage with ferric oxide demulcent , Morphine for pain, I.V. fluids, Blood transfusion if required , Intravenous hypo is useful , purgatives. BAL given 3 mg/kg as 10% solution in Archis oil with Benzyl benzoate, deep intra muscularly, 4 hourly for 2 days, 6 hourly on 3rd days and 12 hourly till 10th day.

Arsenic in view of Ayurvedic ¹⁷
Harital(Orpiment), *Manashila(Realgar)*, and *Gauripasan(White arsenic)* are the commonly used Arsenical product in Ayurvedic medicine of India for wide range diseases after *Shodhan maran*. *Gauripasan* is now accepted in western medicine as first line chemotherapeutics agents against certain hematopoietic cancer. The arsenical compound are main active ingredients in Ayurvedic

formulations or as auxiliary agents to assist the efficacy of herbal drugs. Many toxic metals are used in Ayurveda after *Shodhana* (purification) and *marana* (calcination). Shodhana is a method of triturating herbs and animal’s product and heating of metals to metamorphosed into herbo mineral. It is a process to convert Inorganic materials to organic compound for better absorption, assimilation, reduce toxicity and to enhance the medicinal properties. Ayurveda well defined the toxic effect after ingestion of arsenicals without proper purification methods of Arsenical compounds.

Table no. 4 –Toxic effect of and therapeutic uses of Arsenicals of Ayurvedic

Name of arsenic product	Chemical formula	The therapeutic dose	Toxicity	Therapeutic uses
<i>Harit aal (orpiment)</i>	As ₂ S ₃	30-60 mg	Serious skin manifestation, burning, wasting diseases, neurological manifestation	Skin diseases ‘irregular fever, fistula in ano, piles and, sinus, nonheal ulcer, cough,

				cold, bronchitis, aphrodisiac, syphilis, cancer				
<i>Manashila (Realgar)</i>	As ₃ S ₄	15-30 mg	Asmari(stone),Dysuria,Anoxia and skin manifestation	Skin diseases, anorexia, wasting diseases like cancer and tuberculosis, chronic fever, vitiligo, infection diseases	As ₂ S ₃	churna or Kushmanda swarsa for 3 days	a, Talakabhasma, Talkeshwarasa, Talasindoor, Nityanandanarasa, Manthanbhairavrasa, Raktapittankarsarasa, Rasendragutika, Vataganjakushakra sa, Vidyadhararasa, Sannipathabhairavrasa, Sameerpannagarasa etc	As ₂ S ₃
<i>Gauripasan (White Arsenic)</i>	As ₂ O ₃	1-4 mg	Burning, skin manifestation, Death	Syphilis, Elephantiasis, anemia, psoriasis, asthma, osteoarthritis, Splenomegaly, Impotency, Cancer	Manashila (Realgar) As ₃ S ₄	Shadgunabalijararasinidosa or 2 ratti for 7 days with madhu, sitopala di churna or any anupana.	Kalagneebhairavrasa, kalanarasa, Kulvadhurasa, Krumikashtharasa, Krumivinishanarasa, Krumiharrasa, Kshayakesarirasa, Gadamurarirasa, Trilukyachintamani rasa, Parnakhandeshwararasa, manashiladighruta, mrityusanjivanirasa, Mrutyuutthapan, shwaskutharrasa, etc.	Manashila (Realgar) As ₃ S ₄

Table no. 5- Formulation and antidote of Arsenicals compounds

Name of arsenical	Antidote	Ayurveda formulation	Name of arsenicals
Harit aal (orpinment)	Shar kara + jeera	Kasturibhairav, krumikashthanaalarasa, gulmakarasa, Chandkeshwararasa	Harit aal (orpinment)
			Gauripana (Milk with madhu)

white arsenic)	hu for 3 days	Nityaditras, Mallavati, Mallasindoor, vadvanalras, Sannipatbhairavras , Sameerpannagrassa, Suchikabharanrasa etc	white arsenic)
As ₂ O ₃			As ₂ O ₃

OBSERVATION-

Trituration of curd leads to formation of ghee but it doesn't mean that curd is ghee. Similarly *bhasmas* are prepared form of heavy metals but they are not heavy metals. Proper Sanskar process like *Shodhan, Marana, Amritikarana* gives us *Shuddha bhasma*. After purifications the metals and minerals are subjected to separated cycle of incineration followed by triturating with same herbal juice. Thus the form of product is herbo metallic incinerated form (*bhasma*) with new physical chemical properties. But improper incineration gives us *ashuddhabhasma*, which act like toxic in nature as heavy metals. Heavy metals and *ashudha/apakwa bhasma* has same toxicity exposure. According to Heavy metals, the primary methods of metabolizing arsenic in human is methylation. The main route of excretion of arsenic is the urine.

CONCLUSION-

Heavy metals explained as “Metals has with specific gravity greater than 5”.

Which mean when they are put on to the water they will settle at the bottom. But going by the test for *Bhasmas* for final approval to use on human cases must have a quality *Varitaratwa, Unnami, Rekhapurnatwa, Niruttha etc Bhasma parikshas*. That means it indicate that, in the process of repeated incineration the previous metal got completely destroyed that's why ancient achary named this process as *marana* (Killing of a metals). Thus *bhasmas* are not heavy metels, they are nano particles with a mixture of an organic and inorganic compounds. But if repeated incineration process will not gate done on metals, then proper *Bhasma* preparation will not get. These *bhasma* behave like *ashudha and apakwa bhasma*. So *ashudha bhasma* gives toxic effects. As *Ayurveda* explained *ashudha bhasma* sevan toxic effects which are similar to heavy metal toxicity. This prospective analysis of Arsenicals used in ayurveda medicine has given some light regarding the modern understanding of bioavailability, metabolism, toxicity, biological responses and pharmacological response with background of *Ayurveda* literature.

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