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Review Of Utility Of Visha Chikitsa W.S.R To Endocrine Disrupting Chemicals And Occupational Hazardous Chemicals

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Abstract -

Industrial processes, daily use products and occupational exposures have bring human and many chemicals very much closer than never before. This study focuses on such chemicals - Endocrine Disrupting Chemicals (EDCs) and Occupational Hazardous Chemicals (OHCs) and attempts to find Ayurvedic management of poisoning in patients who have been exposed to these chemicals. EDCs' and OHCs' tend to accumulate in our body in fatty tissues – a phenomenon known as Bioaccumulation. Later they may be released into bloodstream. In this way, once entered into human body, they last life long and keep damaging body tissues, leading to organ failure and even death.

EDCs are found in many everyday products, including plastics, detergents, flame retardants, food, toys, cosmetics, and pesticides. EDCs can alter the hormonal signals that control and guide much of our growth and development, the way our organs function, and our ability to fight disease. Exposure to EDCs is linked with cancers, diabetes, reproductive disorders, neurodevelopmental impairment, and immune system suppression. Also, the OHCs are proven detrimental to human health.

EDCs and OHCs chemicals has close resemblance with *Dushi Visha* and *Gara Visha* in terms of symptoms, complications produced by them.

Key words – Endocrine Disrupting Chemicals, Occupational Hazardous Chemicals, Bioaccumulation, *Dushi Visha*, *Gara Visha*

Introduction –

Lifestyle disorders linked to chemical exposure are endocrine disorders, metabolic syndrome and autoimmune conditions. These are caused by endocrine disrupting chemicals(EDCs), occupational and industrial effluents etc. Today, we have large number of evidences from epidemiologic, animal and cell based studies supporting the fact that even at low dose exposure, EDC's can have important and delayed consequences for human health. EDCs are everywhere. EDCs are found in many everyday products, including plastics, food, toys, and personal care products. The health impacts from EDCs can take many years to manifest, even potentially across generations.

Occupational and industrial effluents like mercury, lead, chromium etc goes untreated into environment and later enters human body through air, water, food chains etc. They affect genetic constitution, foetal growth, development in infancy and puberty, reproduction and even lead to organ failure.

Aim and Objectives –

To review the role of Agadtantra in lifestyle disorders linked to chemical exposure and also to shed light on chemicals which cause such lifestyle disorders, their sources and their mechanism of action

Materials and methods –

Review of Ayurvedic literature and their corresponding commentaries are thoroughly studied. Peer reviewed medical publications and textbook of contemporary medical sciences have also been cited as sources for this topic.

What are EDC's ?

EDC's are chemicals made outside of the body that can block, mimic or otherwise disrupt normal hormone signals. This can result in misinformation that leads to diseases and poor health conditions. The endocrine system sends hormone signals such as estrogen, testosterone, thyroid hormone and insulin from one organ to another and in turn controls cell function in that target organ. Thus it orchestrates vital functions including metabolism, immune function, reproduction, intelligence and variety of behaviour[1].

Types of EDC's –

They are heterogeneous group of agents that can be classified[2] as given in table below. Some EDCs are included in more than one category.

table. classification of edcs

Type	Examples
Plant-derived (phytoestrogens)	Enriched in flaxseed, nuts, soy products, cereals, breads, and legumes **(**genistein, daidzein**)**
Industrial chemicals	Pesticides, flame retardants (per- and polyfluoroalkyl substances **[**PFAS chemicals]), combustion products (polycyclic aromatic hydrocarbons [PAHs]**,** dioxins)**,** lubricants (polychlorinated biphenyls [PCBs])
Household, personal care, consumable items	Cosmetics, sunscreens, hair relaxers, toys, food and beverage packaging materials, contaminated food, contaminated groundwater, tobacco products, bisphenol A (BPA), phthalates, perchlorate, dioxins
Medical supplies	Intravenous tubing, gloves, bags (BPA, phthalates)
Pharmaceuticals	Natural and synthetic steroids (diethylstilbestrol [DES], estradiol)

Routes of exposure — Ingestion of food, dust, and water; Inhalation of gases and particles in the air; Skin contact; Biological transfer across the placenta; or from mother's milk.

table - sources of edc's and their health impacts[3] -

Name	Source	Health Impacts
DES (Diethystibestrol)	Synthetic estrogen – used to prevent miscarriages	Pre term delivery, Neonatal death Clear cell adenocarcinoma Loss in second trimester pregnancy Ectopic pregnancy, Stillbirth Infertility, Early menopause Breast Cancer
Bisphenol A (BPA)	Polycarbonate plastics and epoxy resins Thermal receipt paper and in the linings of food containers	Obesity, Diabetes Cardiovascular diseases Polycystic ovarian disease Low sperm count
Dioxins	Industrial effluents – iron/steel production, chemical industry Burning of plastics.	Skin lesions - Chloracne (painful acne) and hyperpigmentation Hepatotoxicity, Endocrine disruption Teratogenic and fetotoxic chemical in animals.

Flame retardants (prevent ignition)	Furniture – seating foam and coverings, mattresses, carpets Computers, phones, televisions Coating of electrical wires and cables, polystyrene foams	Thyroid disruption; Cancers Immunotoxicity, Reproductive toxicity Adverse effects on fetal and child development and neurologic function
Parabens	Artificial preservatives in cosmetics, shampoo, conditioners, scrubs	Endocrine disruption Developmental and reproductive toxicity Allergens and immunotoxicity
PFAS	Aka **Forever lasting chemicals** – due to strong carbon and fluorine bond, they last longer; Non-stick cooking pans, cosmetics, food packaging, clothing, artificial turf (major cause of plastic pollution);	Thyroid disease Increased Cholesterol levels Liver damage, Kidney cancer Testicular cancer Low birth weight babies Early onset puberty Increased miscarriage risk
Phthalates	Plastic manufacturing – floorings, toys, printing inks, perfumes, nail varnishes	**Males** – Gynaecomastia, disrupted spermatogenesis, breats, prostate and testis cancer **Females** – Menopause, polycystic ovary, Irregular menses, breat, ovary and cervix cancer Obesity, diabetes, Autoimmune disorders
Artificial fragrances	Personal care and cleaning products (contain phthalates, parabens, and synthetic musks.)	
Triclosan	Disinfectants in dish soap, tooth paste, liquid hand soap, surgical cleaning treatments, pesticides	Endocrine Disruption (testosterone, thyroid and estrogen) Breast cancer Antimicrobial resistance

Occupational Hazardous substances and their health impacts[4] –

As the production and use of chemicals in work places around the world increases, workers are ever more at risk of hazardous chemical exposures which are detrimental to their health.

table - OHCs and their health impacts

Substance	Sources	Health effects
Asbestos	Mining and milling Construction, Manufacturing Agricultural plantations Protective textiles	Cancer (Mesothelioma, cancer of lung, larynx and ovary) Asbestosis and pleural disease
Silica	Mining and construction Oil and gas Manufacturing of pottery, ceramics and bricks	Lung Cancer Silicosis
Lead	Ship breaking industry Paint manufacturing	Stomach cancer Neurotoxicity
Mercury	Agricultural plantations Basic metal production Utlities(Gas, water etc) Shipping, ports, fisheries	Neurotoxicity Nephrotoxicity Immunotoxicity Reproductive toxicity
Dyes	Textile, clothing, leather, footwear Food, drinks, Cosmetics Dry cleaning	Cancer

Pesticides	Agriculture Chemical industries	Cancers; Neurotoxicity Endocrine disruption Reproductive toxicity

Properties of EDC's and occupational hazardous chemicals –

- Ability to mimic, arrest or enhance the functions of various body hormones and enzymes
- Many are fat soluble hence are stored in body for long period
- Slower rate of metabolism (Longer the biological half life, slower is the rate of metabolism)
- Colourless, odourless
- Disguised entry in human body through food, air, water, thus causes chonic toxicity and bioaccumulation.

Role of *Agadtantra* –

Acharya Sushruta has mentioned modes of administration of poison as follows –

table – *visha sadhana* and their relevance -

***Visha* Sadhanani[5]**	**Contemporary Relevance**
***Anna* (Food)**	Food and drinks containing dyes and solvents, Genistein (Phytoestrogen found in soybeans), phthalates (food and beverage containers), PFAS (Oil and water repellent – non stick cookware)
***Paana* (Drinks)**	
Dantakashtha	Tooth paste - Sodium Lauryl sulphate (foaming agent), Triclosan, Paraben and propylene glycol (preservatives) Tooth brush – BPA in toothbrush bristles
***Avalekhan* (Comb)**	BPA
***Utsadan* (Ubtan)**	Phthalates (add fragrance to products), Parabens (Preservatives in shampoos, conditioners, deoderants, lotions)
Abhyanga	
Kashaya, Parishek	
***Anulepana* (Unguents)**	
Abhushana	Lead, phthalates, cadmium
Vastra, Shayya	Flame retardants, PFAS,
***Paduka* (Footware)**	Solvents and paints (raw materials) – Benzene, xylene, ethyl benzene etc – cause respiratory diseases, neurotoxicity, cancer, aplastic anaemia, leukemia
***Peetha prushtheshu Gajavajinam* (Saddle)**	Flame retardants in furnitures, seat covers etc

***Visha Guna*[6] –**

Ruksha, Ushna, Tikshna, Sukshma, Ashu, Vyavayi, Vikashi, Vishada, Laghu, Apaki

mechanism of action of edcs and *visha kriya* –

Mechanism of Action of EDCs	***Visha Kriya*[7]**	
Disturb the hormone biosynthesis Bound with receptor and act in agonistic or antagonistic way Alter the receptor function Disrupt negative feedback mechanism Influence hormone transport across cell membrane and signal transduction Bind with transport proteins and influence hormonal distribution Epigenetic alterations Disturb metabolic processes relevant to hormone breakdown	***Visha Guna***	***Kriya***
	Ruksha	*Vata Prakop*
	Ushna	*Rakta – Pitta prakop*
	Tikshna	*Moha janayati, Chhedayati Marma bandha*
	Sukshma	enters every *avayava* of body
	Ashukari	*Prana Nasha*
	Vyavayi	Spreads in whole body
	Vikashi	Destruction of *dosha, dhatu, mala*
	Vishad	*Avyahat gati*
	Laghu	*Dushchikitsya*

	Avipaki	Slow or difficult metabolism and excretion

Concept of *Gara Visha*[8] -

Acharya Charak defines it as *Kalantar Avipaki* (metabolizes slowly) so it does not show acute toxicity but produces many diseases. *Gara visha* is a toxic combination of substances which shows effects after interval of some time and does not kill the patient instantly. *Acharya Vagbhata* classifies it as *Kritrim Visha*. *Acharya Sushruta* and *Vagbhata* opines that the poison which is formed from the waste materials of the animals (excreta) or combinations of medicines or bhasmas which are having opposite properties or the poisons with less potency are called as *Gara visha*.

Types of *Garavisha* –

- ***Nirvish Dravya Samayog kritam*** – Combination of Non poisonous substances eg – *Viruddha Ahara*
- ***Savish Dravya Samayog Kritam*** – combination of poisonous materials which can be termed as *kritrima visha*

Lakshana produced by *Gara Visha*[9] – *Pandu, Jwara, Karshya, Alpagni or mandagni, Adhman , Marma Pradhamana (Hridaya Spandan), Hasta Pada Shotha, Grahani, Rajayakshma, Kshaya, Gulma, Udara*

Treatment of *Gara Visha* –

- ***Shodhana*** – *Vamana* with *Tamra Churna* and *Madhu* for *Hridaya Shuddhi*.
- ***Suvarna Prashana*** (*Suvarna Churna* mixed with *Madhu*) – as *Suvarna bhasma* counteracts all types of poisons and their effects.
- *Acharaya Charak*a has quoted *Tamra Bhasma* as best *vamak dravya* and *suvarna bhasma* as best *vishaghna dravya* in *visha Chikitsa.*
- ***Gara Vishaghna Chikitsa Yogas –***

Yoga	**Contents**
Nagdantyadi Ghrita[10]	*Nagdanti, dantimula, dravanti, Nishottar, Snuhiksheer, Madanphala*
Sharkara Suvarnadi Leha[11]	*Suvarna Makshika* and *Suvarna Bhasma* mixed with *Sugar* and *honey*
Moorva Guduchyadi Churna[12]	*Moorva, Pippali, Guduchi TaGara, Patola, Chavya, Chitraka, vacha, Musta*

Concept of *Dushi visha*[13] -

A part of *Sthavar* (Inanimate), *Jangam* (Animate) or *Kritrim* (Artificial) poison, which accumulates and cannot be excreted from body completely due to it's chronic and cumulative nature or becomes less potent after digestion or counter action of antidotes and accumulates in the body for a prolonged period and keeps vitiating the body slowly is called *Dushi visha*. *Virya* of *Dushi visha* being less, it does not show any immediate fatality. On the other hand, it becomes *avritta* by *kapha* (Lipophilic binding) and accumulate in that state for years.

***Lakshana*[14] and *Updrava*[15] Produced by *Dushi visha* –**

- ***Lakshana*** - *Annamada, Avipaka, Arochaka, Anaha, Chhardi, Atisara, Mandal, Kotha, Vaivarnya, Kushtha, Moha, Murchha, Trishna, Unmada, Dhatukshaya, Shukrakshaya, Hasta, Pada and Mukha Shopha, Dakodara, Dushyodara*
- ***Updrava*** - *Jwara, Daha, Murchha, Hikka, Anaha, Atisara, Shukrakshaya, Shopha*

Treatment of *Dushi Visha* –

- ***Swedana*** - *Acharya Charak*a has mentioned *Visha Rogi* as *Snehana Swedana Anarha* whereas *Acharya Sushruta* advises *swedana*. *Acharya Dalhana* says even if it is *Visha*, it is *Manda Veerya* and *Kapha Avritta*. *Sweadana* will help to break this *kapha avarana* and bring this *Visha* into *Koshtha*, this will make *Shodhana Upkrama* easy.

- ***Vamana*** and then ***Virechana***
- ***Raktamokshana*** – *Charak* says *Dushi Visha* first vitiates *Rakta dhatu* and then other *doshas*. Thus he advises *Raktamokshana* as first *upkrama*.
- ***Dushi visha Upadrava* Chikitsa** – Use *Vishaghna dravyas*
- ***Chikitsa Yoga* –**

Kalpa	**Contents/Properties**
Dushi vishari Agad[16]	*Pippali, Kattruna, Jatamansi, Lodhra, Kevati Motha, Suvarchika, Sukshma Ela, Swarnagairik* with honey
Ikshvaku Kalpa[17]	*Vishaghna*
Sudha Kalpa[18]	*Garavishaghna*

Discussion –

There has been rising incidence of exposure to EDCs and OHCs. They have ability to accumulate inside the bosy tissues. Thus they keep causing chronic toxicity. They can damage vital systems of body and can cause cancers, endocrine disorders, hepato renal failure, respiratory diseases etc

EDC's and OHCs which are being considered here have properties which closely resembles with *Gara Visha* and *Dushi Visha*. *Gara visha* is also termed as *kritrim Visha*, thus it encompasses EDC's and OHCs. These are metabolised slowly and sometimes doesn't cause immediate fatality. On the other hand *Gara visha* itself falls under the category of *Dushi visha* because it is *kritrim visha*. Exposure to RDCsand OHCs leads to bioaccumulation as found in *Gara visha* and *Dushi visha*.

Bioaccumulation is a process of accumulation of chemicals in an organism that takes place if the rate of intake exceeds the rate of excretion. Thus, longer the biological half life of the substance the greater the risk of chronic poisoning. Many bio accumulative chemicals are fat soluble i.e *Kapha Avarana*. This has resemblance with *Dushi Visha*.

Conclusion –

EDCs and Occupational Hazardous chemicals have same fate as those of *Dushi Visha* and *Gara Visha* in human body. They have same properties like slower rate of metabolism, ability to accumulate (many being fat soluble), thus causing chronic toxicity. Treatment principles and *chikitsa yogas* mentioned in *Dushi Visha* and *Gara Visha* Chikitsa have potential to treat patients with chronic exposure to these EDCs and occupational hazardous chemicals who show systemic manifestations of *Visha*.

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