

Therapeutic potentials of metals in ancient India: A review through *Charaka Samhita*

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ABSTRACT

The *Ayurvedic* system of medicine has stood the test of time for four millennia or more. The ancient seers found that drugs of different origin (herbal, metal or animal) in addition to codes of conduct and dietary regulations are suitable tools to maintain health in healthy and eradicating diseases in diseased. Use of metallic preparations in healthcare is a unique feature in this system. Processed metals including Mercury, Gold, Silver, Lead, Zinc, Copper etc. were used very frequently by seers of the Indian tradition in different disease conditions with great authority. It is generally claimed, that these metals are detoxified during the highly complex manufacturing processes described in *Ayurvedic*, especially *Rasashastra* texts. *Charaka Samhita*, one of the scheduled books of *Ayurveda* also holds ample of references regarding the use of metals for different purposes, which are summarized in the current paper.

Key words: *Ayurveda*, *Charaka Samhita*, lead, mercury, metals

INTRODUCTION

The *Ayurvedic* system of medicine has great antiquity, dating back to about 5000 years B.C. Its Materia Medica contain resources in the form of drugs derived from plant, animal, metal and mineral sources,^[1] the use of which have been advocated in various different pathological manifestations. These drugs have also been converted in to poly-herbal, herbo-mineral and metallic compound formulations by the seers, who have documented their clinical experiences and passed on the knowledge to further generations.

During the medieval period, with the advent of *Rasashastra*,

use of certain heavy metals and minerals in *Ayurvedic* therapeutics increased. *Rasashastra*, an integral part of *Ayurveda*, deals with the drugs of mineral origin, and details their varieties, characteristics, processing techniques, properties, therapeutic uses, possibilities of developing adverse effects and their management etc. in a comprehensive way. Although the roots of this science (*Rasa Shastra*) exist in the ancient texts of Indian civilization, its development as an independent system of therapy started around the 8th century A.D. *Ayurvedic* classics written before that time, like *Charaka Samhita* and *Sushruta Samhita* etc. contain descriptions of metals and minerals, their processing techniques and their utilization in therapeutics etc.

In due course of time, herbo mineral and metallic preparations came to occupy a significant seat in *Ayurvedic* pharmacopoeia and have routinely been used in practice in different parts of India for many centuries. Such preparations are held to be safe, efficacious even in minute doses, and, when manufactured and used following specified classical guidelines, not to lead to any significant untoward effects.^[2] The past decade, however, has witnessed concerns by the western scientific community, regarding the safety of *Ayurvedic* Herbal, Herbo-mineral and metallic preparations, which is a major concern for the age-old *Ayurvedic* heritage.^[3]

This paper attempts to screen *Ayurvedic* classics for

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references emphasizing the utilization of metals for medicinal and other purposes. *Charaka Samhita* was scrutinized and found to contain referred frequent references to metals used for different purposes including medicinal and non medicinal ones. Seer *Charaka* advocated converting the metals in to fine powders before their utilization and observing great caution during the period of administration in different disease manifestations.

OBJECTIVES

The present paper is a compilation holding references pertaining to metals during the period of *Charaka Samhita* along with some information on the metals explained in textbooks of *Rasashastra* and modern science.

The references found in the classic were grouped into different categories with an intension to give an insight about the frequency of usage of the metals. The categories are as under:

- Utilization in therapeutics
 - Internal administration
 - External application
- Utilization in the preparation of equipment/instruments
- Other purposes etc.

Parada (Mercury)

Formulations containing mercury are only rarely mentioned in *Charaka Samhita*. The first reference pertaining to *Parada* and its utility in therapeutics mentioned in the classic is controversial,^[4] only a few scholars interpret the term *Rasa* in the verse *chikitsasthana* 7/71 as *Parada*. The second reference is found in *Dwivranija Chikitsa*, where the term *Rasa* is interpreted as *Parada* by the commentator *Chakrapani*.^[5] It is interesting to note that, both these formulations are recommended for external application. [Table 1].

Though the term '*Rasa*' has been rendered as '*Parada*' by '*Chakrapani*', it is very difficult to claim that mercury was in practice during the period of *Charaka* for the following reasons.

1. The term '*Parada*' was not used by *Charaka* throughout the classic.
2. If the metal had been known to the physicians of those

days, we might expect that it would have been discussed frequently, along with associated pharmaceutical procedures, and its combinations.

3. *Chakrapani* is silent and doesn't expressed an opinion on the term '*Rasa*' at *Chikitsa* 7/71, but interprets the same term in the earlier verse (*Chikitsa* 7/70) as 'expressed juice', while, at *Dwivranija Chikitsa* (25/116), he interprets '*Rasa*' as *Parada*.
4. Later works like *Susruta Samhita* (*Chikitsa* 25/39) and *Astanga Hridaya* (*Uttara* 13/36) preferred mercury as a component in topical applications. It was only later that the frequency of its internal utility increased. Probably, these developments might have been noticed by redactors and commentators like *Dridhabala* and *Chakrapani*, who expressed their opinions in their respective works.

Swarna (Gold)

Swarna, the *Sara Lauha*^[6] is an important, noble metal known to Indians since antiquity. References can be traced back to *Charaka* and *Susruta Samhita* where the noble metal has been attributed with a wide range of applications. The '*Bhasma*' form of Gold is in metallic state. Quantitatively it is a combination of metallic Gold (96.76%), silica (1.14%), ferric oxide (0.14%), phosphates (0.78%), potash (0.16%), salt (0.078%), and traces of copper and magnesium.^[7]

In its elemental form, Gold has been employed for centuries as an anti-pruritic agent to relieve itching palms. In 1980, Robert Koch observed that gold inhibits *Mycobacterium tuberculosis in vitro*. This led to trials on arthritis and lupus erythematosus. Also, previous studies carried out in 1973 on gold and its compounds observed beneficial activities at different levels. Gold compounds have the ability to decrease concentrations of rheumatic factors and influences the immunological responses.^[53] It has also been established^[54] that gold suppresses the anaphylactic release of histamine more effectively than gluco-corticoids. Sodium aurothio malate (water soluble preparation) was introduced around 25 years ago to treat arthritis, and is administered through IM injections. Its pharmacokinetics were not established but, its effects are probably due to its antimicrobial effects and stimulation of the Reticulo Endothelial system.^[8]

Various formulations of '*Swarna*' are useful: *Vrishya*, *Balya*, *Rasayana*, *Medhya*, *Ayushya*, *Ojo Vardhaka*, *Vayah sthapaka* etc.^[9] and disease alleviators particularly in chronic debilitating diseases like *Raja Yakshma*, *Swasa*, *Kasa*, *Pandu* etc.^[10] Normal dose levels given for '*Swarna Bhasma*' is 15 mg. to 30 mg.^[11] References pertaining to *Swarna* in *Charaka Samhita* have been depicted in Table 2.

Table 1: Depicting the references of Parada

Reference	Formulation	Uses
Utilization in therapeutics: External Application		
<i>Chikitsa</i> 7/71	<i>Lelitaka Prayoga</i>	<i>Kushtha</i> (Skin disorders)
<i>Chikitsa</i> 25/116	<i>Savarnikarana Lepa</i>	<i>Savarnikarana</i> (enhances complexion of the skin)

Table 2: Depicting the references of Swarna for different purposes

Reference	Formulation	Therapeutic uses
Utilization in therapeutics: Internal Administration		
Chikitsa 1-1/58*	Brahma Rasayana – II	Rasayana (Rejuvenators)
Chikitsa 1-3/23	Lohadi Rasayana	
Chikitsa 1-3/25	Indrokta Rasayana	
Chikitsa 1-3/46	Triphala Rasayana	
Chikitsa 1-4/22	Apara Indrokta Rasayana	
Chikitsa 4/79	Pana Yoga	Raktapitta hara (Bleeding Disorders)
Chikitsa 23/239**	Curna Yoga	Visha hara (Anti-poisonous)
Chikitsa 23/240	Curna Yoga	
Utilization in therapeutics: External Application		
Chikitsa 3/262	Sheet of the metal	Pitta Jwara (Fever of Pitta origin)
Chikitsa 21/131	Curna Yoga	Granthi (Abscess)
Preparation of Equipment / Instruments etc.		
Reference	Description	Probable translation
Sutra 5/74	Jihva Nirlekhana Dravya	Tongue Scrappers
Sharira 8/44	Nabhi Kartana Dravya	Scissors for cutting umbilical cord
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot
Chikitsa 1-2/4***	Suvarna Bhajana	Vessels and Containers
Chikitsa 24/15 ****		
Chikitsa 24/154 ****		
Sharira 8/19	Purusha Anupramanam under Pumsavana Karma	A very minute sized idol of male gender
Sharira 8/34	Teekshna Soochi Shastra	Sharp instruments to be used in labor room
Other purposes		
Vimana 8/9	Alankritam	Wearing gold / gold ornaments
Vimana 8/11		
Sutra 5/18	--	General reference regarding Shodhana
Sutra 1/70	Parthiva Dravya Ganana	Sub-classification of the metal-based source

*Kanaka one of the synonyms for gold referred even at *Brahma Rasayana - I* (Chikitsa 1-1/49) and at *Madhwasa* (Chikitsa 7/74), which has been clarified as *Nagakasara* by the commentator *Chakrapani*. **The dose of *Swarna Churna* (powder of gold) mentioned here is 1 *Shana* (3 g), ***Pharmaceutical procedure is to be carried out in Gold vessel. ****Water stored in gold vessel is to be consumed.

Rajata (Silver)

Rajata (Silver), another noble metal like gold, also attracted the attention of the ancient *Acharyas*. The use of silver in therapeutics dates back to the period of *Charaka* and his contemporaries. Though, its therapeutic applications are not as extensive as other metals like *Tamra* or *Loha*, the ancient classics reveal that silver also enjoyed an important place in Ayurveda therapeutics.

Classics of alchemy say s that, samples of *Rajata* which are clear, lustrous (*Swachha*), heavy (*Guru*), and with metallic sheen (*Snigdham*), and which also become bright white on heating or cutting (*Dabe Chede Samaprabham*), without any ridges or furrows (*Sphota rabitam*), is genuine, and can be considered acceptable for therapeutic purposes.^[11] Quantitatively '*Rajata Bhasma*' is a combination of metallic silver (52 to 59%), free sulphur (0.675%), ferric oxide (14.33%), calcium (10.769%), silver chloride (0.479%), and traces of sodium, potassium and aluminium.^[13] Various useful formulations of '*Rajata*' are: *Balya*, *Rasayana*, *Medhya*, *Ayushya*, *Ojo Vardhaka*, *Vayab sthapaka* etc. The normal dosage range given for '*Rajata Bhasma*' is 30 mg. to 120

mg.^[14] The references of *Rajata* in *Charaka Samhita* as one of the components are listed in Table 3

Tamra (Copper)

Tamra (Copper) is another ancient metal known to human civilization. During pre-Vedic times, the metal was part of day-today livelihood functions. Further, it is the earlier known metal for the preparation of the stronger alloy metals brass and bronze of which it is a component. *Charaka* uses the term *Arka* in a few places which *Chakrapani* clarifies as synonymous with *Tamra*.^[15] According to the descriptions of *Rasa* in *Vagbhata* Ref. there are two forms of *Tamra* viz. *Nepaliya* and *Mlechha*, only the former being acceptable. Samples with characteristic metallic sheen (*Snigdham*), soft (*Mridulam*), bright reddish in color (*Shonam*), having high tensile strength (*Ghanaghata Ksamam*), heavy (*Guru*), and devoid of impurities (*Nirvikaram*) are identified as best used for medicinal purposes.^[16]

Formulations of '*Tamra*' are useful in a wide range of diseases like *Krimi*, *Sthauhya*, *Arsha*, *Ksaya*, *Pandu*, *Kusta*, *Swasa*, *Kasa*, *Amlapitta*, *Sotha*, *Sula*, *Yakrit Roga* and *Grahani dosha* etc.^[17] In addition, *Charaka* advocates the use of *Tamra Patra* (copper

Table 3: Depicting the references of Rajata for different purposes

Reference	Formulation	Therapeutic Uses
Utilization in therapeutics: Internal Administration		
Chikitsa 1-1/58	Brahma Rasayana - II	Rasayana (Rejuvenators)
Chikitsa 1-3/23	Lohadi Rasayana	
Chikitsa 1-4/22	Apara Indrokta Rasayana	
Chikitsa 16/78	Tapyadi Loha	Pandu Roga (Hematinics)
Chikitsa 16/82	Yogaraja	
Chikitsa 17/126	Muktadi Curna	Hicca (hiccup), Swasa (respiratory distress)
Preparation of Equipment / Instruments etc.		
Reference	Description	Probable Translation
Sutra 5/74	Jihva Nirlekhana Dravya	Tongue scrappers
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot
Siddhi 9/51	Pushpa Netra Dravya	
Sharira 8/9 **	Rajata Patra	Silver containers
Chikitsa 1-2/4 *		
Chikitsa 24/15 **	Rajata Bhajana	
Chikitsa 24/154 **	Rajata Patra	
Sharira 8/19	Purusha ... anupramanam under Pumsavana Karma	Idol of male gender
Sharira 8/34	Teekshna Soochi Shastra	Sharp instruments to be placed in labor room
Sharira 8/44	Nabhi Kartana Dravya	Scissors for cutting umbilical cord
Other purposes		
Vimana 8/9	Alankritam	Wearing gold / gold ornaments
Vimana 8/11		
Sutra 1/70	Parthiva Dravya Ganana	Classification of the metal based on the source

*Pharmaceutical procedure is to be carried out in Silver vessel, **Water stored in Silver vessel is to be consumed

vessels) in several pharmaceutical procedures.^[18] Normal doses mentioned for 'Tamra Bhasma' is 15 mg to 60 mg.^[19] The references mentioned in *Charaka Samhita* that hold Tamra as one of the active components are listed in Table 4.

Ayasa or Loha (Iron)

Next to Swarna, Rajata and Tamra, Loha or Ayasa is another metal known to ancient civilizations. During the period of Charaka, it was used in different dosage forms named Curna, Vati, Avaleba, Varti, Asavarishita etc. either for external or internal administration in a number of pathological manifestations. Iron compounds were particularly employed in diseases such as anaemia and other debilitating conditions, where functions of hemopoietic systems are disturbed and the blood has consequently become deficient in iron. Rasa Shastra classics explain that Loha is par excellence a rejuvenator as it stimulates functional activity of all the organs, promotes life, strength, destroys a number of diseases, and acts as a restorative.^[20] The utility of this metal in therapeutics was only identified in modern medicine in the first half of the 17th century, when its salts were recognized as the best haematinics. According to descriptions in Rasa Vagbhata, there are three varieties of Loha viz. Munda, Teekshna and Kanta, the latter being the best variety to use.^[21]

As preparations of Loha are of foremost importance in

Ayurveda therapeutics, proper care should be taken during procedures for its purification and incineration. Chakrapani stresses the need to take care when administering it.^[22] Charaka emphasizes a special Ayaskeriti procedure, which converts thin leaves of metal into a fine absorbable form.^[23] In addition to these uses, iron vessels were specifically recommended to be used in certain pharmaceutical procedures (Chikitsa 1-3/43, 15/187, 16/83, 26/250, 26/274 etc.) Quantitatively, it is a combination of ferric oxide (96.5%), ferrous oxide (2.5%), magnesium oxide (0.8%), calcium oxide (0.3%), together with traces of phosphorus and potassium. Different formulations of 'Loha' are useful in a wide range of diseases: Sula, Arsha, Gulma, Pliha Roga, Yakerit Roga, Ksaya, Pandu, Kamala etc.^[24] Normal dose levels given for 'Loha Bhasma' are 30 mg. to 240 mg.^[25] List of the formulations mentioned in Charaka Samhita that hold Loha as one of the active components are depicted in the Table 5.

Mandura

Mandura, the second form of Iron, has been used for a wide range of therapeutic procedures in classical Ayurveda since antiquity. It is defined by Madhava Upadhyaya in the Ayurveda Prakasha as the debris collected after heating and beating processes of Iron around a blacksmith's anvil.^[26] Generally, mandura is collected from sources like old anvils, and is considered to be very useful, if they are about 100 years old.

Table 4: Depicting the references of Tamra for different purposes

Reference	Formulation	Therapeutic Uses
Utilization in therapeutics: Internal administration		
Chikitsa 1-1/58	Brahma Rasayana - II	Rasayana (Rejuvenators)
Chikitsa 1-4/22	Apara Indrokta Rasayana	
Chikitsa 17/126	Muktadi Curna	Hicca (hiccup), Swasa (respiratory distress)
Chikitsa 23/239	Curna Yoga	Visha hara (Anti-poisonous)
Utilization in therapeutics: External application		
Chikitsa 7/86	Lepa Yoga	Kusta (Skin disorders)
Chikitsa 21/131	Curna Yoga	Granthi (Abscess)
Chikitsa 26/246	Sukhavati Varti	Collyrium for Akshi Roga (Eye disorders)
Preparation of Equipment / Instruments etc.		
Reference	Description	Probable translation
Sutra 5/74	Jihva Nirlekhana Dravya	Tongue scrappers
Chikitsa 7/117*	Tamra Bhajana	Copper containers
Chikitsa 26/255 *		
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot
Other purposes		
Sutra 1/70	Parthiva Dravya Ganana	Classification of the metal based on the source
Sutra 1/131	Visha Kwathita Tamra	Simile for disrespect of a quack

*Pharmaceutical procedure is to be carried out in copper vessel.

Samples of ages 80 years and 60 years old are respectively considered moderately and least efficacious for therapeutic purposes.^[27] According to the literature Mandura, which is smooth to touch (*Snigdha / Masruna*), heavy (*Guru*), strong (*Dridham*), without any fissures or furrows (*Kotaravarjitam*), and taken from age old constructions (*Jirna nasta purastham*) is genuine and can be used for therapeutic purposes.^[28]

Purified *mandura*, when administered with proper justification is beneficial in inflammations, edematous conditions, jaundice etc. It is the drug of choice in cases of anaemia (*Pandu*), and *Charaka* refers to a number of its preparations. Chemically, *Mandura* is a combination of ferric oxide (59.14%), ferrous oxide (26.7%), chlorides (4.4%), magnesium (3.9%), sodium (1.7%) and a few other elements in trace quantities. Its unique constitution plays a pivotal role in therapeutics of anaemia and other associated disorders.^[29] The normal dose given for '*Mandura Bhasma*' is 30 mg. to 240 mg. 30 Few of the formulations mentioned in *Charaka Samhita* that hold *Mandura* as one of the active components are depicted in Table 6.

Naga/Sisaka (Lead)

Naga is an important *Puti Loha* known since ancient times, also identified by other terms like *Sisaka* or *Sisa*. *Charaka* emphasizes that medicinal uses of this metal should be external, particular in cases of *Mandala Kusta*. The *Brihad Rasa Raja Sundara* describes two varieties of *Naga* viz. *Kumara* and *Samala* the former being the acceptable variety for therapeutic applications. Samples which melt easily (*Drutadravam*), and are heavy (*Mahabharam*), externally black in color (*Babihkrishnam*), and when incised shine with bright black luster (*Chede Krishna Samujwalam*) should

be considered genuine and preferred for therapeutic purposes.^[31] Quantitatively *Naga Bhasma* is a combination of lead oxide (75.6%), ferric oxide (7.5%), together with traces of calcium and magnesium chlorides and carbonates.

Different formulations of '*Naga*' are beneficial in diseases like *Prameha*, *Gulma*, *Arsha*, *Sweta Pradara*, *Grabani roga*, *Antra sotha* etc.^[32] Therapeutic dosages given for '*Naga Bhasma*' range from 30 mg. to 120 mg. ^[33] References mentioned in *Charaka Samhita*, that hold *Naga* as one of the components are depicted in Table 7.

Vanga/Trapu (Tin)

Vanga, one of the *Puti Lohas* was known to ancient Indian physicians by the name of *Trapu*. In *Charaka Samhita*, the metal is categorized under *Parthiva Dravyas*. According to descriptions in *Rasa Vagbhata*, there are two varieties of *Vanga* viz. *Khuraka* and *Mishraka*, the former being acceptable for therapeutic applications. Samples with the characteristics, bright white in color (*Dhavalam*), soft (*Mridulam*), shiny, smooth (*Snigdham*), easily melts (*Drutadravam*), and heavy (*Guru*) are identified as *Khura Vanga* and should be preferred for therapeutic purposes.³⁴ Quantitatively *Vanga Bhasma* is a combination of stannic oxide (i.e. of tin) (91.4%), ferric oxide (2.9%), potassium (2.9%), calcium oxide (2%), aluminium (2%) and magnesium (0.6%) oxides.

Formulations of '*Vanga*' are variously beneficial in diseases such as: *Prameha*, *Kasa*, *Shwasa*, *Krimi*, *Ksaya*, *Pandu*, *Pradara*, *Garbbashaya Chyuti* etc.^[35] Singly or in combination with other *puti lohas*, it is beneficial in disorders of the Genito Urinary Tract. It has also been said that, *Vanga Bhasma* is

Table 5: Depicting the references of Loha for different purposes

Reference	Formulation	Therapeutic uses
Utilization in therapeutics: Internal Administration		
Sutra 21/23	<i>Sthaulyahara Yoga</i>	<i>Sthaulya</i> (Obesity)
<i>Chikitsa</i> 1-1/58	<i>Brahma Rasayana</i> - II	<i>Rasayana</i> (Rejuvenators)
<i>Chikitsa</i> 1-3/16	<i>Lohadi Rasayana</i>	
<i>Chikitsa</i> 1-3/52	<i>Shilajatu Rasayana</i>	
<i>Chikitsa</i> 1-4/22	Apara Indrokta Rasayana	
<i>Chikitsa</i> 7/74	<i>Madhwasa</i>	<i>Kusta</i> (skin diseases), <i>Kilasa</i> (leukoderma)
<i>Chikitsa</i> 12/21	<i>Shophahara Yoga</i>	<i>Kaphaja Shoph</i> a (inflammation of Kapha origin)
<i>Chikitsa</i> 12/39	<i>Triphaladyarishta</i>	<i>Arsha</i> (hemorrhoids), <i>Pandu</i> (anemia)
<i>Chikitsa</i> 12/42	<i>Shophahara Yoga</i>	<i>Chiraja Shoph</i> a (chronic inflammation)
<i>Chikitsa</i> 12/43	<i>Ksara Gutika</i>	<i>Arsha</i> (hemorrhoids), <i>Pandu</i> (anemia) etc.
<i>Chikitsa</i> 13/73	<i>Shamana Yoga</i>	<i>Kaphaja Udara</i> (Ascitis of Kapha origin)
<i>Chikitsa</i> 15/188	<i>Panchama Ksara</i>	<i>Grahani</i> (malabsorption syndrome), <i>Pandu</i> (anemia)
<i>Chikitsa</i> 16/69	<i>Panduhara Yoga</i>	<i>Pandu</i> (anemia)
<i>Chikitsa</i> 16/70	<i>Navayasa Curna</i>	
<i>Chikitsa</i> 16/82	<i>Yogaraja</i>	
<i>Chikitsa</i> 16/97	<i>Kamalahara Yoga</i>	<i>Kamala</i> (jaundice)
<i>Chikitsa</i> 16/98		
<i>Chikitsa</i> 16/99		
<i>Chikitsa</i> 16/105	<i>Gaudarishtha</i>	<i>Pandu</i> (anemia)
<i>Chikitsa</i> 16/119	<i>Panduhara Yoga</i>	<i>Mridbhakshana Pandu</i> (anemia of pica origin)
<i>Chikitsa</i> 17/126	<i>Muktadi Curna</i>	<i>Hicca</i> (hiccup), <i>Swasa</i> (respiratory distress)
<i>Chikitsa</i> 17/129	<i>Swasahara Yoga</i>	
<i>Chikitsa</i> 30/84	<i>Yonirogahara Yoga</i>	<i>Yoni roga</i> (disorders of female genital tract)
Utilization in therapeutics: External Application		
Sutra 14/26	<i>Swedana Dravya</i>	Material for sudation
<i>Chikitsa</i> 5/62	<i>Daha Karma</i>	<i>Gulma</i> (abdominal lump)
<i>Chikitsa</i> 7/88	<i>Kustahara Yoga</i>	<i>Kusta</i> (skin diseases)
<i>Chikitsa</i> 7/171	<i>Kilasahara Lepa</i>	<i>Kilasa</i> (leukoderma)
<i>Chikitsa</i> 9/80	<i>Sparsha Chikitsa</i>	<i>Unmada</i> (psychosis)
<i>Chikitsa</i> 21/131	<i>Curna Yoga</i>	<i>Granthi</i> (abscess)
<i>Chikitsa</i> 25/103	<i>Agni Karma</i>	<i>Kaphaja Granthi</i> (abscess of Kapha origin)
<i>Chikitsa</i> 25/115	<i>Savarnikarana Lepa</i>	<i>Savarnikarana</i> (provides complexion to the skin)
<i>Chikitsa</i> 26/246	<i>Sukhavati Varti</i>	Collyrium for <i>Akshi roga</i> (eye disorders)
<i>Chikitsa</i> 26/250	<i>Sukhavati Varti</i>	Collyrium for <i>Akshi roga</i> (eye disorders)
<i>Chikitsa</i> 26/254	<i>Dristiprada Varti</i>	Collyrium for <i>Akshi roga</i> (eye disorders)
<i>Chikitsa</i> 26/280	<i>Lepa Yoga</i>	<i>Khalitya</i> (alopecia)
<i>Chikitsa</i> 26/282		
Preparation of Equipment / Instruments etc.		
Reference	Description	Probable Translation
<i>Sharira</i> 8/19	<i>Purusha ... anupramanam</i> under <i>Pumsavana Karma</i>	Idol of male gender
<i>Sharira</i> 8/34	<i>Teekshna Soochi Shastra</i>	Sharp instruments to be placed in labor room
<i>Sharira</i> 8/44	<i>Nabhi Kartana Dravya</i>	Scissors for cutting umbilical cord
<i>Chikitsa</i> 25/82	<i>Shalaka Nirmana</i>	Metallic probes
<i>Chikitsa</i> 1-3/43 *	<i>Ayasa Patra /</i>	Iron Vessel / Container
<i>Chikitsa</i> 7/75 *	<i>Ayasa Bhanda /</i>	
<i>Chikitsa</i> 15/187 *	<i>Ayasa Bhajana /</i>	
<i>Chikitsa</i> 16/82 *	<i>Loha Patra</i>	
<i>Chikitsa</i> 26/274 *		
Other purposes		
Sutra 1/70	<i>Parthiva Dravya Ganana</i>	Classification of the metal based on the source
Sutra 1/131	<i>Visha Kwathita Tamra</i>	Simile for disrespect of a quack
<i>Chikitsa</i> 12/7	<i>Swayathu Hetu</i>	Creator of inflammation

*Pharmaceutical procedure is to be carried out in Iron Vessel / Container

Table 6: Depicting the references of Mandura

Reference	Formulation	Uses
Utilization in therapeutics: Internal Administration		
Chikitsa 16/74	Mandura Vataka	Pandu (anemia)
Chikitsa 16/78	Tapyadi Yoga	
Chikitsa 16/95	Punarnava Mandura	
Chikitsa 16/103	Mandura Vataka	

Table 7: Depicting the references of Naga for different purposes

Reference	Formulation	Uses
Utilization in therapeutics: Internal Administration		
Chikitsa 17/126	Muktadi Curma	Hicca (hiccup), Swasa (respiratory distress)
Utilization in therapeutics: External Application		
Chikitsa 7/88	Lepa Yoga	Kusta (skin diseases)
Other purposes		
Sutra 1/70	Parthiva Dravya Ganana	Classification of the metal based on the source

Table 8: Depicting the references of Vanga for different purposes

Reference	Formulation	Uses
Utilization in therapeutics: External Application		
Chikitsa 7/88	Lepa Yoga	Kusta (skin diseases)
Preparation of Equipment / Instruments etc.		
Reference	Description	Probable Translation
Sutra 5/74	Jihva Nirlekhana Dravya	Tongue scrappers
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot
Other purposes		
Sutra 1/70	Parthiva Dravya Ganana	Classification of the metal based on the source

the drug of choice in the case of *Prameha*.^[36] Therapeutic doses given for '*Vanga Bhasma*' range from 120 mg. to 240 mg.^[37] The references mentioned in *Charaka Samhita*, which hold *Vanga* as one of the components are depicted in Table 8

Pittala (Brass)

Pittala is an important *Misra Loha*, an alloy of *Copper* and *Zinc*, known since the period of *Sambhita Kala*. *Charaka* used this metal to prepare *Vasti netra*. It is known as Brass. As per the descriptions available in *Rasa Ratna Samuchaya*, there are two varieties of *Pittala* viz. *Ritika* and *Kakatundi*.

Formulations of '*Pittala*' are beneficial in diseases like *Krimi*, *Kusta*, *Pandu* etc.^[38] The therapeutic doses given for '*Pittala Bhasma*' range from 60 mg. to 120 mg.^[39] Very few references mentioned in *Charaka Samhita* that hold *Pittala* as one of the components are depicted in Table 9.

Table 9: Depicting the references of Riti for different purposes

Reference	Description	Probable Translation
Sutra 5/74	Jihva Nirlekhana Dravya	Tongue scrappers
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot

Table 10: Depicting the references of Kamsya for different purposes

Reference	Description	Probable Translation
Sharira 8/9*	Kamsya Patra	Containers of Bronze
Siddhi 3/7	Vasti Netra Karnika Dravya	Nozzle of enema pot
Chikitsa 24/154*	Kamsya Bhajana	Vessels and containers

*Water placed in Kamsya vessel is to be consumed.

Kamsya (Bronze)

Kamsya is another important *Misra Loha*, an alloy of *Copper* and *Tin* known since the period of *Sambhita Kala*. *Charaka* used this metal to prepare *Vasti netra*. It is known as Bell Metal or Bronze. According to the descriptions given in *Ayurveda Prakasha*, there are two varieties of *Kamsya* viz. *Pushpa* and *Tailika*, only the former being acceptable for therapeutic applications. Samples giving a sharp sound (*Teekshna Shabdham*), soft (*Mridu*), smooth to touch (*Snigdha*), slightly grayish (*Eshat Shyamalam*), clear from impurities (*Shubhram/Nirmalam*) and turning red on heating (*Dabe Raktam*) possess the characteristic features of the material preferred for therapeutic purposes.^[40]

Formulations of '*Kamsya*' are beneficial in diseases like *Krimi*, *Kusta* etc.^[41] Therapeutic doses even for '*Kamsya Bhasma*' range from 60 mg. to 120 mg.^[42] Very few references mentioned in *Charaka Samhita* that hold *Kamsya* as one of the active components are depicted in Table 10.

DISCUSSION

It becomes clear from screening the classic *Charaka Samhita* that metals like Gold, Silver, Iron, Copper, Lead, Tin etc. as well as some alloys were used to treat a wide range of diseases. Fine powders of these metals were prescribed for both internal and external applications. References also can be traced where the metallic powders were applied to the eyes.^[43] Emphasis is given to purification of metals and their conversion to micro-fine powders by following specified guidelines, processes which were termed '*Ayaskriti*'. *Charaka* suggest using these metallic preparations with great authority, stating them to be safe and efficacious if used judiciously. He also emphasizes that great caution is needed when using such metallic powders in therapeutics.

In addition to the therapeutic utilization; different

metals ranging from gold to iron were also used in preparing equipments like *Jihva Nirlekha Yantra* (tongue scrappers),^[44] *Nabhi Kartana Yantra* (sharp instruments to cut umbilical cord),^[45] *Vasti Netra* (nozzle of enema pot),^[46] different *Anjana Shalakas* (metallic applicator for application of medicaments into eyes)^[47] etc. Besides this, Charak recommends preparing containers and vessels with different metals like gold^[48], silver^[49], copper^[50], iron^[51] and some alloys^[52] etc. where instructions for pharmaceutical procedures like boiling etc. are given.

Close scrutiny makes it clear that such metallic preparations have held a significant place in *Ayurvedic* pharmacopoeia since antiquity. In the recent past, western scientists have begun to focus on the toxic nature of metals like mercury, lead etc. Reviewing the *Ayurvedic* literature reveals that ancient scholars had considered the possibility of toxicity of metallic preparations, and emphasized the necessity of taking great care over this point. They evolved specific methods using various pharmaceutical techniques like *shodhana*, *jarana*, *marana* etc. which have their own significance in detoxifying and increasing the therapeutic potential of metals.

CONCLUSIONS

Reviewing *Charaka Samhita* reveals that Ayurveda utilized metals for various therapeutic and non-therapeutic purposes. The text emphasizes the need to observe great caution while using metals, and directs that they should be reduced to micro-fine powders through the specially designed process '*Ayaskriti*'. The reduced metals may contain associated compounds together with major elements, which have their own significance in the process of disease pacification. In addition, a few of the metallic powders also may provide nourishment, as they are a combination of many trace elements and electrolytes. In the recent past, some researchers have suggested that these metallic/mineral preparations are anti-oxidants which fight free radicals, and disease causing organisms and also help in developing immunity.^[55] Studies carried-out in different parts of India have indicated that, when metals and minerals are converted into medicines strictly adhering to the classical guidelines specified in ancient texts, they are devoid of any toxicity even at the level of 100 TEDs. Histo-pathological studies of visceral organs in these studies revealed no apparent changes. For example, a study on *Rasa Karpura*, established safety of the compound even at 40 TED.^[56]

Furthermore, the effectiveness of *Ayurvedic* medicines is not usually due to single active ingredients, but, usually to complex mixtures of compounds which target the

pathological manifestation in several different ways. Therefore, *Ayurveda* differs from systems of medicine using single ingredients.

Keeping all these in mind, it can be said that the damning reports such as those of unacceptable levels of heavy metals etc. in *Ayurvedic* preparations should not be considered cause for alarm. The concepts, practices and products of the *Ayurvedic* system of medicine are unique, and its therapeutic values are needed to be explored by utilizing and adopting sophisticated technology, Only then can ailing humanity benefit from its age-old remedies.

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