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A LITERARY REVIEW ON TAMRA VISHA (COPPER) W.S.R. TO NEPHROTOXICITY

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ABSTRACT

One such metal is tamra, which is extremely dangerous and many times more toxic than poison itself because, whereas poisons only have one dosha (Toxic effect), unpurified and unreduced tamra has eight doshas. However, if this Tamra is properly processed through the entire pharmaceutical process, it can be turned into one of the most superior and potent medications. Tamra Bhaska is helpful in treating a variety of illnesses, including Pandu, Udar Vyadhi, and others. This work searches and analyzes all Ayurvedic and contemporary perspectives to provide a descriptive analysis of Tamra and its therapeutic potential, which are referenced in our traditional Ayurvedic texts with particular reference to its involvement in nephrotoxicity. Due to its color and flavor, copper should not be self-injected for suicidal or self-harm purposes. Poisoning happens by mistake most of the time. Eating food contaminated with verdigris, which is created by vegetable acids acting on copper cooking vessels that are not adequately tinned within, can lead to accidental poisoning. Excessive copper levels can cause a variety of harmful health effects, including liver and kidney damage, anemia, immunotoxicity, and developmental toxicity. Almost every system is impacted by copper, either directly or indirectly. Many symptoms of copper poisoning are caused by copper-mediated insufficiency, which is a lack of vitamin C, folic acid, or other minerals generated by copper toxicity.

KEYWORDS: Tamra Visha, Copper Toxicity, Khaneeja Visha Dravya, Copper, Mineral Poison, acute renal failure.

INTRODUCTION

While pure metallic copper is not toxic, copper salts—particularly blue vitriol, sometimes referred to as verdigris and nila thotha—are hazardous. One of the most well-known enzyme inhibitors is copper.[1] t is said that copper originated in Cyprus, where abundant copper mines were exploited by the Romans. The Latin word Cuprum is where the name "copper" came from (CU). The element in question is metallic, and its symbol is CU. It has an atomic weight of 63.546 and an atomic number of 29.[2] Many cases of copper toxicity lead to the unintentional ingestion of contaminated water sources or their installation, the use of topical burn creams containing copper salt, and the cooking of acidic foods in uncoated copper cookware. Most of the time, poisoning is an accident. Eating food tainted with verdigris, which is created by the action of vegetable acids on copper cooking vessels that are not thoroughly tinned on the interior, can lead to accidental poisoning. Excessive copper levels can cause a variety of harmful health effects, including liver and kidney damage, anemia, immunotoxicity, and developmental toxicity.

AIM AND OBJECTIVES

Aim

To study Tamra from various classical texts with special reference to its role in mutravaha srotas dusti-chronic kidney disease.

Objectives

To explore the Tamra Visha toxicity on mutravaha srotas leading to CKD in ayurvedic literature

MATERIALS AND METHOD

1. Source of data literary study done by collecting data from Bruhatrayi, Laghutrayi & all Rasashastra classical texts.
2. Including journal, website, internet
3. Previous work done.

REVIEW OF LITERATURE

Tamra

With an extensive history, tamar has been used as medicine in the field of Ayurveda since the beginning. References to it (As coins, utensils, and ornaments) can be easily found in a variety of literatures, including the Veda, Upanishada, and Purana. The references to Tamra and its Visha Lakshana can be found throughout the Charaka Samhita. As rasashastra metal evolved, it was thoroughly investigated, documented, and employed for medicinal purposes. TamraVisha creates eight varieties of Visha Lakshana. Brahma (euphoria), Murccha (syncope), Vidaha (burning feeling), Sweda (perspiration), Kleda (excessive sebum secretion), Vamana (vomiting), Aruchi (anorexia), and Cittasannipata (restlessness) are the eight.[3]

Modern review

Copper is an essential trace element obtained mainly from foods, such as shellfish, organ meats, whole grain products, seeds, and nuts, but recent studies suggest that circulating copper concentrations are also to some extent genetically determined.[4] Alteration of circulating trace elements in many body organs including the brain, heart, kidney, and liver have been involved in trauma related deaths.[5,6] Excessive dietary copper intake can lead to deposition of copper in the kidney and cause nephrotoxicity characterized by proximal tube necrosis that results through oxidative stress, cellular injury, and leads to a decline in kidney function.[7] However, the interplay between copper and kidney disease is bi-directional as imbalances in the homeostasis of circulating copper levels may also occur as a result of impaired renal excretion and changes in protein metabolism in patients with chronic kidney disease (CKD).[8] In fact, the regulation of copper levels in CKD patients is important to prevent complications. In previous observational studies, elevated circulating levels of copper have been associated with CKD.[9]

Poisonous compounds of copper[10,11]

Copper Sulfate (Blue vitriol), Copper Subacetate (Verdigris or zangal), Copper Arsenite, and Copper Acetoarsenite (Scheele's green or Paris green) are the chemicals that are toxic forms of copper. The most frequent cause of poisoning out of them is copper sulfate, followed in line by copper subacetate. Copper sulfate is a bright blue crystal that turns white and highly hygroscopic when heated to between 220 and 240 degrees Celsius. It then absorbs water from the atmosphere and turns blue once more. When metallic copper is applied to organic acid,

copper subacetate, which is available as minute blue crystals, is produced. CuSO4 is one of the most prevalent salts, and it tastes metallic, bitter, and styptic. Water freely dissolves copper sulfate, which is what gives the hue. Copper subacetate, on the other hand, is primarily soluble in fatty mediums.

S. N.	Poisonous compounds	Common name	Features
01	Copper sulphate	Blue vitriol, *Nilathotha* (Hindi)	Blue crystalline powder
02	Copper subacetate	Verdigris, Zangal	Green crystalline Powder
03	Copper aceto arsenite	Paris Green	Emerald green powder
04	Copper arsenite	Scheele's Green	Greenish powder
05	Copper carbonate	Mountain Green	Green crystalline powder

Widespread applications[12]

- Electrical products: Copper windings for engines, electrical wirings, etc.
- Alloys: A lot of brass and bronze alloys contain copper.
- Used for Bullets: Nickel bullets were worn in this jacket.
- Pesticides: A lot of pesticides are made using trace amounts of copper or polymers containing copper.
- Insecticides: Copper molecules are utilized in insecticides.
- Insect repellents: These are used to ward off insects.
- Art industries: Used to prepare a variety of artistic designs.
- Cattle poison: CuSO4 has also been used to induce abortions and kill cattle.
- To impart rich green color: In canned and preserved peas, as well as in other green vegetables.

Environmental copper exposure[13]

Copper pollution in the atmosphere originates from both natural and human sources. Dust rich in metal is produced during copper mine excavation, and the wind will disperse it across the mine site. Businesses that use copper to produce metals, electrical equipment, fungicides, pesticides, and other products that contain copper frequently discharge contaminated water into the drainage system, which then flows into streams and other bodies of water. Additionally, the usage of pesticides increases the amount of copper compounds in the atmosphere, which may have an impact on people who consume unwashed fruits and vegetables treated with these pesticides. Copper used in plumbing in buildings slowly degrades and helps the metal enter the water supply. The combustion of fossil fuels, old

motor oil, paint, worn-out brake pads, and some birth control techniques are other sources of water contamination.

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Occupational copper exposure[14]

For personnel who are exposed to copper over an extended period of time in many industries that handle copper, the exposure is moderate. There's growing evidence that repeated exposure to these kinds of exposures can have a variety of negative impacts on health. Despite being necessary for optimal health, excessive copper exposure is harmful to human health. Prolonged exposure to copper dust can lead to headaches, nausea, diarrhea, and irritation of the mouth, nose, and eyes. Exposure to copper fumes has been linked to cases of metal fume fever. Hepatomegaly, intestinal issues, and a variety of respiratory signs and symptoms are additional consequences that have been recorded. Copper used in plumbing in buildings slowly degrades and helps the metal enter the water supply. The combustion of fossil fuels, old motor oil, paint, worn-out brake pads, and some birth control techniques are other sources of water contamination. Both the degree and duration of exposure to copper are likely to exacerbate the severity of the effects.

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Other copper exposure sources[15]

1. Copper cookware: Copper cookware, such as tea kettles, can cause copper poisoning if used often and over extended periods of time.
2. Birth control pills: Increasing the body's copper levels is one of the pill's adverse effects. This is a result of the robust correlation between copper and oestrogen levels.
3. Intrauterine devices with copper: It is easy to absorb several hundred milligrams of copper annually via a copper IUD. Despite being pulled off the market, many women continue to use the intrauterine birth control device known as Copper-T. Currently, the only intrauterine birth control method available for purchase is the Copper-T. These can be extremely dangerous devices for women who are sensitive to high copper levels.

4. Vitamin and Mineral supplements: Supplements containing vitamins, particularly those for pregnant women, frequently include copper. While some may benefit from this, many other women may suffer negative consequences.
5. Fungicides for Foods and Swimming pools: To prevent the formation of algae and fungus, copper sulphate is added to swimming pools and can be sprayed on fruits and vegetables.
6. Vegetarianism and Other high copper diets: Copper is present in a wide variety of foods. Specifically, vegetarian proteins with a high copper concentration include soybeans, nuts, seeds, avocados, tofu, and grains. Soy is used in fast food burgers and other everyday items.
7. Because it is less Expensive and Has a lower cholesterol content, soybean protein is frequently used. More foods high in copper include organ meats, shellfish, yeast, maize oil, bran, and wheat germ.
8. Dental appliances: Dental alloys that are used in crowns, fillings, and other appliances include copper.

Excretion and Absorption[16,17,18]

The typical amount of copper in the body is 150 mg. Copper is a normal element of the body. The recommended daily allowance of dietary copper is two to three milligrams. After consumption, the stomach and jejunum absorb copper at their highest rate. It exists in two forms: one bound to albumin, and the other to the copper enzyme ceruloplasmin. Copper is absorbed through the skin, lungs, gastrointestinal tract, mucous membranes, and uncooked surfaces. It is primarily eliminated by the bowels as opposed to the kidneys through bile, and remnants can be discovered in milk and saliva. Humans excrete very little copper through their urine. Adults excrete 25 g of urine every 24 hours.

Fatal dose[19]

- Copper sulphate: 20 g (0.15-0.3 g/kg).
- Copper subacetate, 15g.

Treatment of chronic copper poisoning[20]

- Initially, the focus is on eliminating the source of poisoning and preventing further exposure.
- Ensuring access to fresh air is essential.

- Administering massages and warm baths can be beneficial.
- Providing a well-balanced diet is important.
- Copper vessels should be coated with tin and maintained meticulously clean.

Post-mortem appearances[21,22,23]

1. Yellowing of the skin may be observed.
2. Greenish-blue froth might be present at the mouth and nostrils.
3. Gastric contents and the mucosa may appear greenish or bluish.
4. Gastric mucosa may exhibit congestion, swelling, inflammation, and occasional erosion.
5. The liver could present as soft and fatty.
6. Mild to moderate irritation in the upper part of the small intestine may occur.
7. Spontaneous hemolysis of blood and degenerative changes in the kidney's proximal tubules may be evident.
9. Ulceration or perforations may be visible in the colon and rectum.
10. In cases of chronic poisoning, the gums may appear with a bluish lining, accompanied by mucosal atrophy. The liver and kidneys may display varying degrees of degeneration.

Medico legal aspects[24,25,26,27]

1. Homicidal use of copper is rare due to its color and taste; however, instances of mixing copper sulfate with powdered glass, sweetmeats, or other foods have been reported.
2. Swallowed copper coins may remain in the stomach or intestines for days without causing poisoning symptoms. However, copper can act as a poison when alloyed with other metals and reduced to a fine powdery state.
3. Copper sulfate is commonly used as a preservative or coloring agent in vegetables. It's also utilized to impart a rich green color to tinned green peas and mango pickles. Toxic effects are usually not produced due to the small quantities added.
4. Copper is a normal and essential constituent of the human body, found in urine, feces, blood, other biological fluids, and the liver. Normal serum levels are around 151.6 micrograms.
5. Suicide cases involving copper are rare.
6. Accidental poisoning may result from consuming food contaminated with verdigris, formed from the action of vegetable acids on improperly tinned copper cooking vessels.
7. Toxicity may develop from copper wire in intra-uterine contraceptive devices or tubes used in hemodialysis equipment.

8. Copper salts are occasionally taken internally for abortion purposes.
9. Rarely, copper is used as a cattle poison.
11. Chronic poisoning is considered an industrial hazard.
12. Copper sulfate has been used as an antidote in phosphorus poisoning and wound debridement.

Copper sulphate Poisoning and Acute renal failure

The human body needs copper as a cofactor for oxidative enzymes such Dopamine-B-hydroxylase, peroxidase, catalase, and cytochromeoxydase. However, it may result in both acute and long-term intoxications, which can be extremely harmful. Peptides or amino acids in the stomach absorb copper, which is then carried to the liver or bound by a protein resembling matallothieonein that is activated by elevated copper levels in the plasma. About 95% of the plasma copper in the liver is carried by ceruloplasmin and amino acids, which are bonded to copper. The suppression of sulphahydryl group enzymes, like glutathione reductase and G-6PD, which are crucial for shielding the cell from free oxygen radicals, is what causes copper's harmful effects. Workers spraying grape vines with copper sulfate solution to prevent mildew have been reported to have pulmonary interstitial fibrosis as a result of a granulomatous lesion.[28]

In India, intentional self-inflicted death by copper phosphate consumption is not uncommon. Sometimes it might also be an accident. Many of the patients are young women, some of whom have graduated from science programs, with easy access to chemistry labs. Hemorrhagic gastritis, vomiting, nausea, diarrhoea, and epigastric discomfort are the early symptoms. These are followed by the onset of acute tubular necrosis and intravascular hemolysis a few hours later.[29]

Patients receiving dialysis have also been shown to have acute poisoning while using copper tubing in the heating coil[30] Following copper sulphate overdose, sulfhemoglobinemia and abrupt renal failure have also been seen.[31]

Since many of the victims of acute copper sulfate poisoning did not experience severe hemolysis or hypotension, the origin of the acute tubular necrosis appears to be direct toxicity to renal tubular cells. Renal ischemia is caused by a combination of factors, including severe intravascular hemolysis and circulatory failure brought on by extensive gastrointestinal

bleeding. Poor prognostic indicators included significant gastrointestinal bleeding, liver injury, and delayed presentation (Greater than three days).

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