Environmental pollutants and human diseases: diagnosis and treatment

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Abstract

Environmental factors play a central role in the processes of human development, health, and disease. Human exposure to hazardous agents in the air, water, soil, and food and to physical hazards in the environment is a major contributor to increased morbidity and mortality. Hazardous substances that originally are discharged as air pollutants may find their pathway to human exposure through multiple routes, including ingestion and dermal contact, as well as direct inhalation. The mechanisms for modeling and understanding the fate of air pollutants through atmospheric transport, deposition into water and soil, bioaccumulation, and ultimate uptake to receptor organs and systems in the human body are complex. A single contaminant source often may represent only a fraction of a total body pollutant burden. The EDTA chelation therapy enables the removal of toxic metals and excess calcium from the body.

In this study we present results related to the detoxification treatment through continuous intravenous infusion of EDTA of 78 patients with cardiovascular problems and chronic fatigue syndrome. A comparison between toxic metals found in urine before and after the chelation-therapy treatment has been carried out. EDTA has been administered before urine collection, and a wide range of toxic metals (mercury, lead, arsenic, cadmium, nickel, and others) has been measured with reference to urine creatinine.

1 Introduction

Health effects originated by air pollutants range from subtle biochemical and physiological changes to difficult breathing, wheezing, coughing and aggravation of existing respiratory and cardiac pathologies. Many health effects

are directly associated with breathing of polluted air, but air also transports pollutants and deposits them onto soils or surface waters, where they can potentially affect plants, crops, property, and animals. Toxic substances in plants and animals can move through the food chain and pose potential risks to human health.

Through eating, breathing and skin absorption, some contaminants (namely Aluminium, Mercury, Iron, Lead, Cadmium) can be accumulated into the body and become a source of excess free radicals. Natural detoxification pathways of the body cannot eliminate them and the build-up can eventually reach toxic and dangerous levels. Too much Iron can give rise to heart problems and high levels of Lead and Cadmium can trigger high blood pressure. In addition high levels of toxic metals can lead to chronic fatigue and multiple chemical sensitivity (MCS) syndrome also known as environmental illness.

EDTA is well recognized as a therapy for Lead toxicity. EDTA also removes other toxic heavy metals such as Iron, which promote cancer, by catalyzing free radical pathology.

The intravenous infusion of Ethylene Diamine Tetra-Acetic Acid (EDTA), together with certain minerals and vitamins in measured dosages, is the main part of the chelation therapy treatment. A slow-drip method is used to administer such infusion, which flows through the bloodstream and, in the process, flushes out toxic metals. EDTA, the main component of chelation therapy has the capacity to bind with toxic heavy metals, such as Lead, Cadmium, Aluminium, and Mercury, and pull them out of the body in the urine, through the kidneys.

Large amounts of oral and intravenous antioxidants are given with chelation therapy, especially E and C vitamins. Treatment is aimed at removing accumulation in the body of harmful levels of Aluminium, Iron, Copper, and toxic heavy metals, all of which enhance free radical damage. Treatment objectives also include the removal of metastatic calcium from soft tissues, enhancement of the levels of ionic magnesium at cellular level, and reduction of pathologically enhanced clotting mechanisms, especially platelet adhesiveness. These mechanisms of action were described in the extensive review article by Cranton and Frackelton [1].

Chelation therapy protocol is a multifarious procedure that combines intravenous EDTA, nutrition therapies, and lifestyle changes.

Increased urinary Lead excretion after injection of EDTA is a recognized test for heavy metals accumulation in the body. Urinary toxic metals excretion was measured before and after EDTA infusion in 78 patients and, in each case, a substantial increase in heavy metals excretion was measured.

The purpose of this study is to determine more precisely and to statistically analyze the reduction of some pollutant elements after treatment with EDTA.

2 Human health and heavy metal exposure

Metals, a major category of globally distributed pollutants, are natural elements that have been extracted from the earth and harnessed for human activities and products for millennia.

Metals are notable for their wide environmental dispersion from such activity, their tendency to accumulate in select tissues of the human body, and their overall toxicity even at relatively minor levels of exposure.

Some metals, such as Copper and Iron, are essential to life and play irreplaceable roles, for example, in the functioning of critical enzyme systems. Other metals are xenobiotics, i.e. they have no useful role in human physiology (and that of most other living organisms) and may be toxic even at trace levels of exposure as for Lead and Mercury. Even those metals that are essential, however, have the potential to turn harmful at very high levels of exposure.

Exposure to metals can occur through a variety of routes. Metals may be inhaled as dust or fume (tiny particulate matter, such as the Lead Oxide particles produced by the combustion of leaded gasoline). Some metals can be vaporized (e.g., Mercury vapor in the manufacture of fluorescent lamps) and inhaled. Metals may also be ingested involuntarily through food and drink. The amount that is actually absorbed from the digestive tract can vary widely, depending on the chemical form of the metal and on the age and nutritional status of the individual. Once a metal is absorbed, it distributes in tissues and organs. Excretion typically occurs primarily through the kidneys and digestive tract, but metals tend to persist in some storage sites, like liver, bones, and kidneys, for years or decades.

The toxicity of metals most commonly involves the brain and the kidney, but other manifestations occur, and some metals, such as Arsenic, are clearly capable of causing cancer. An individual, even under high-dose and/or acute metal toxicity, typically has very general symptoms, such as weakness or headache. This makes the diagnosis of toxicity of metals, in a clinical setting, very difficult unless a clinician has the knowledge and training to suspect the diagnosis and is able to order the correct diagnostic test. Chronic exposure to metals at a high enough level to cause chronic toxicity effects (such as hypertension in individuals exposed to Lead and renal toxicity in individuals exposed to Cadmium) can also occur in individuals who have no symptoms. Much about metals toxicity, such as the genetic factors that may render some individuals especially vulnerable to metals toxicity, remains a subject of intense investigation. Perhaps, low-level exposure to metals could contribute to the causation of chronic diseases and impaired functioning much more than previously thought.

3 EDTA Chelation therapy

Heavy metals such as Lead, Mercury, Cadmium, Arsenic, Nickel, and Antimony have been shown to relentlessly accumulate in human tissue over a lifetime. These poisonous metals disrupt the normal biochemical processes. They insinuate themselves into the active sites of enzymes thereby altering such enzymes' activities, and they initiate “free radical reactions”, which produce noxious chemicals that damage cellular structures such as proteins, cell membranes and DNA. The results at the level of the whole organism are the development of degenerative diseases, arteriosclerosis, arthritis and cancers. The removal of these poisonous metals with Chelation Therapy is probably a major

means by which Chelation normalizes biochemical activity thereby improving circulation and energy.

The word “chelation” derives from the Greek word chele, which is the claw of a crab or lobsters. Chelation is thus the natural process of a pincer-like binding of metallic ions to the chelating substance. In the case of Chelation Therapy, a chelating agent does the grasping and a metal atom is the grasped object. This chelating agent forms a very stable chemical complex with a mineral or metal ion known as a “heterocyclic ring structure”. There are many examples of chelates in nature such as magnesium in the chlorophyll molecule in plants, iron in the hemoglobin of blood cells in man and other higher organisms and the incorporation of cobalt in the vitamin B-12 molecule.

Chelation is a process whereby the metals are held and positioned by body chemicals so as to facilitate chemical reactions, which are essential to life. Intravenous Chelation Therapy is the introduction by slow infusion of naturally occurring or synthetic organic chemicals into the human body in order to facilitate chemical reactions, which lead to the discharge of poisonous metals from the body and the rearrangement of essential metals in the body for the promotion of life's chemical reactions.

The synthetic chelator, intravenous EDTA (Ethylene Diamine Tetra-acetic Acid, an amino acid) is used in this study as chelating agent (Fig.1).

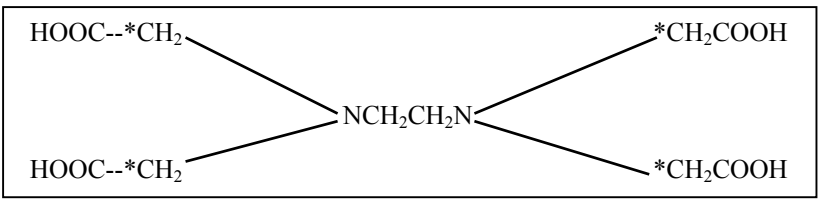

Figure 1: EDTA molecular structure.

The EDTA drags abnormal metal ions out of the body, reducing the production of free radicals. A free radical is an oxygen molecule with an odd number of electrons in an outer orbital ring of one of its atoms. This characteristic makes the free radical violently reactive with almost any and every cell structure, leading to damage and eventually to degenerative disease processes such as arteriosclerosis. By significantly reducing these reactions, chelation therapy allows the body to heal itself and reverse the disease processes.

In addition, chelation also mobilizes calcium from the bones and other tissues. This actually stimulates additional bone deposition, improving bone density. Calcification of tissues is generally caused when free radical damage upsets cell membranes. This leads to tissue and organ malfunction and eventually to death. Thus the reversal of this process by EDTA chelation therapy can be seen as a true longevity treatment.

Free radicals can damage DNA, which in turn can lead to the development of cancer. A study has shown [2] that EDTA chelation therapy has a protective effect on the development of pollution diseases.

3.1 Mechanism of EDTA

EDTA was synthesized in Germany in 1935, and first patented in the US in 1941. Its first uses were in industry as a chelating agent, as an anticoagulant for clinical laboratory use, and as a treatment for lead poisoning. In 1955, Dr. Norman Clarke, then Director of Research of Providence Hospital in Detroit, Michigan, reported on his use of intravenous EDTA to dissolve what he referred to as "metastatic calcium". Metastatic calcium is calcium that has been deposited where it is not wanted, as in arteries (atherosclerosis), joints (arthritis), kidneys (kidney stones), and the bony ossicular system in the ears (otosclerosis), with generally unfavorable results. Since 1955, hundreds of papers have been published on the effects of chelation therapy in a variety of chronic diseases, the vast majority reporting favorable results.

The first, and probably most widely held belief is that the benefits are due to EDTA's ability to bind with ionic calcium in the blood. This temporarily lowers the blood calcium level, which stimulates the parathyroid gland to release parathyroid hormone (PTH). PTH, in turn, stimulates osteoclastic and osteoblastic activity of the bone, mobilizing calcium from unwanted parts of the body (i.e., arteries, joints, etc).

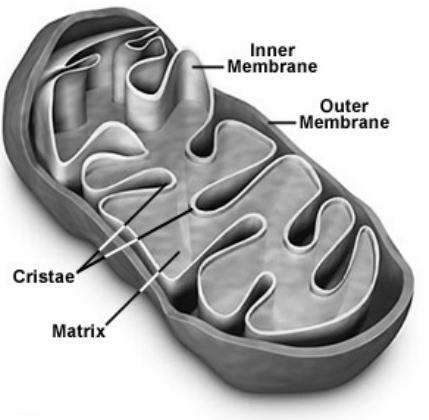

Figure 2: Mitochondria.

One more significant mechanisms of intravenous EDTA may be that of its ability to “restore mitochondria”. Mitochondria are the "power plants" of every cell in the body (Fig. 2). Within the mitochondria the process of oxidative phosphorylation takes place to generate energy by producing ATP without which life could not exist. Loss of mitochondrial function has long been considered as one of the primary causes of the aging process [3-5]. Recently, the role of impaired mitochondrial function in the pathogenesis of many diseases has been reported [6-8]. EDTA was recognized ever since the 50's to have the ability to stabilize mitochondria [9].

The one issue that all chelating physicians overwhelmingly agree on is the great benefits that can be obtained in a variety of degenerative, age-related conditions, using this safe and non-invasive therapy.

3.2 Free Radical theory

In the normal course of metabolism, our body produces small high-energy particles that are known as free radicals. These are unstable molecules with free electrons that can be used for energy production and numerous other physiological functions. In some cells they may be used as the weapons to kill viruses and bacteria. Unfortunately, because of their extremely high energy, they can also be damaging to normal tissues if too many of them are produced.

Free radicals disrupt the normal generation of DNA and alter the lipids (fats) in cell membranes. They also affect the blood vessels and the production of prostaglandins. Prostaglandins regulate many physiological functions. Free radicals are also found in the environment. There are many sources of excess free radicals, including certain metals (such as excess iron), cigarette smoke, air pollution, drugs, poisons, highly processed foods and food additives, ultraviolet sunlight and radiation

According to the free radical theory, perhaps 80-90% of all disease process is an excess of free radical activity [6-9].

Every oxygen factor also has an antioxidant factor in our physiological systems. In other words, we are normally capable of neutralizing the harmful effects of atoms and molecules that have a high affinity with other elements and chemicals, and would otherwise damage tissue and cells in attaching to cellular components.

Whenever one side or the other of this oxidation/anti-oxidation free radical system becomes unbalanced, damage accrues. This damage leads to diseases of the circulatory system, malignancies, inflammatory conditions and immunologic disorders [9].

EDTA chelation therapy removes metals that act as catalysts for the production of excessive free radical reactions, thus the disease process and/ or repairing the damage. The body, to prevent the damage due to free radicals, uses compounds known as antioxidants.

4 Data analysis

A group of 78 adults was considered in this analysis. All patients resided in two Italian cities, namely Bologna [10] and Ascoli Piceno. The treated group consisted of 43 women and 35 men.

The study patients received slow infusion of EDTA plus vitamin C, vitamin B6, vitamin B12, Potassium, Magnesium, Pantothenic Acid, Taurine, Glutathione and B complex. The purposes of the vitamin and mineral cocktails are:

- to replace the minerals lost due to the action of the coupling agents;
- to re-supply the minerals identified to be in inadequate quantities in the bodily stores;

- to supply antioxidant protection before or after detoxicant program;
- to alkalize the body fluids, which promote better enzymatic and immune functions;
- to supply in large pharmacological doses the Krebs cycle enzyme cofactors and other enzyme systems, which force cellular uptake, thus providing energy, enhanced detoxification and repair;
- to supply the nutrients to prevent the formation of Homocystiene, a potent oxidizer, which damages the lining of the blood vessels causing atheriosclerosis.

Increased urinary lead excretion after injection of EDTA (i.v. EDTA) is a recognized test for heavy metals accumulation in the body. Urinary excretion of heavy metals, namely lead, Aluminium, Mercury, was measured before and after EDTA infusion in all patients. The normal range of metal values is 0-20 mcg/l for lead and aluminium and 0-15 mcg/l for mercury.

The results of this analysis are summarized in Tables 1, 2 and 3 where a comparison between toxic metals found in urine before and after the chelation-therapy treatment has been illustrated.

Table 1: Lead found in urine before and after the intravenous EDTA treatment.

Measured Pb values before i.v EDTA (μg/l)	Number of Patients	Measured Pb values after i.v. EDTA (μg/l)	Number of Patients
0-20	74 (94.9%)	0-20	37 (47.4%)
21-30	4 (5.1%)	21-88	32 (41.0%)
		89-155	4 (5.1%)
		156-223	5 (6.5%)

Table 2: Aluminum found in urine before and after the intravenous EDTA treatment.

Measured Al values before i.v EDTA (μg/l)	Number of Patients	Measured Al values after i.v. EDTA (μg/l)	Number of Patients
0-20	38 (48.7%)	0-20	16 (20.5%)
21-50	26 (33.3%)	21-88	40 (51.3%)
59-95	7 (9.0%)	89-155	15 (19.2%)
95-132	7 (9.0%)	156-223	7 (9.0%)

Table 3: Mercury found in urine before and after the intravenous EDTA treatment.

Measured Hg values before i.v EDTA (μg/l)	Number of Patients	Measured Hg values after i.v. EDTA (μg/l)	Number of Patients
0-15	78 (100%)	0-15	46 (59.0%)
		16-26	22 (28.2%)
		27-37	7 (8.9%)
		38-69	3 (3.9%)

In each case, a substantial increase in metals excretion was measured after the intravenous EDTA treatment.

5 Discussion

It is clear from the Tables 1, 2 and 3 that before chelation treatment 94.9% of the patients had Lead values within normal range (0-20 mcg/l); after EDTA chelation treatment only 47.4% had normal lead levels and some patients presented lead levels ten times the normal values.

Regarding Aluminium levels, we can observe that before chelation treatment 48.7% of the patients had lead values within normal range (0-20 mcg/l) while after EDTA chelation treatment only 20.5% had normal aluminium levels.

100% of the patients did not present alarming urinary Mercury excretion before injection of EDTA (over 15 mcg/l); after intravenous EDTA only 59% had values within normal range.

These results demonstrate that increased urinary heavy metal excretion after intravenous EDTA chelation can be considered the recognized test for the accumulation of heavy metals in the body. Consequentially, chelation therapy benefits may still however be primarily the result of the obvious heavy metal detoxification.

6 Conclusions

Through eating, breathing, skin absorption, and everyday exposure to limitless products and chemicals made and used by humans, contaminants find their ways into the body.

Over time these heavy metals, toxic chemicals, plaques and other unnatural intruders continue to slowly accumulate. Whenever the body's natural detoxification pathways cannot eliminate them faster that they enter the body, the buildup can, eventually, reach toxic and dangerous levels. Urinary toxic metals excretion after intravenous EDTA infusion has demonstrated that patients

excreted a large quantity of lead, aluminium and mercury reducing the "toxic metal deposits".
Chelation Therapy can be used as the primary treatment for heavy metal intoxication by lead, cadmium, aluminum, mercury, arsenic, and even iron.

The Chelation therapy consists of the intravenous infusion of a solution containing Ethylene Diamine Tetra-acetic Acid (EDTA), along with vitamins, minerals, and other substances. Because this therapy involves the vascular system, and because blood flow affects every cell in the body, it is not surprising to find a wide ranging set of lack-of-health conditions improved or outright cured after its use.

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