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Role of free radicals in atherosclerosis and its homoeopathic management

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Abstract

Free radicals play very important role in human health, but they also cause damage of cells, aging and produce number of illness. This article focuses the effects of free radicals in formation of atherosclerosis which ultimately manifest as various sign & symptoms and also discuss the various homoeopathic remedies to deal with this condition.

Keywords: Free radicals, atherosclerosis, homoeopathy, homoeopathic remedies

Introduction

Human body made up of numerous cells. These cells together form tissues, & organs. Different process happens within these cell determine how long you live, & whether you live healthy or with the burden of diseases.

Free radicals are essential to a number of biochemical & physiological process, but when there is an alteration between the free radical formation & elimination then it causes damage to the cell & produces a number of diseases.

Defination

Free radicals are atom, molecule or ion with one or more unpaired electron or open cell configuration. Free radicals may have positive, negative or zero charged. These unpaired electron cause radical to be highly reactive.

Type

- Oxygen Centered Free Radicals: Superoxide (O₂⁻), & hydroxyl (OH⁻) radical. They are the oxygen reactive species (ROS).
- Nitrogen Centered Free Radicals: Nitrogen (II) oxide NO[•], Nitrogen (IV) oxide NO₂[•].

Free radical mediated tissue damage ^[7]

Action of free radical increased due to primary (e.g.; excess radiation exposure) or secondary (e.g.; tissue damage by trauma) actions during various biological activities — discharge of ROS by polymorphonuclear, Xanthine oxidase triggering, iron released from sequestered sites, stimulation of phospholipases, etc. There is some equilibrium between the formation & elimination of free radical. Whenever there is failure in this equilibrium that leads to oxidative stress.

Oxidative stress due to exogenous factor

- Ionizing emission.
- Excess availability of transition metals.
- Side effect of drug & poisonous chemical.
- Oxygen overload & increased concentration of oxygen.

Oxidative stress due to endogenous factor

- Phagocyte staffing & stimulation at injured site.
- Dispersion of transition metal & escape of haem.
- Diminution of defensive capability as well as reduced antioxidant enzyme.
- Decreased level of antioxidant.
- Leakage or damage of antioxidant.

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This factor may be jointly interactive & direct to production of radicals. As they are excessive active in character they easily can joint with different molecule, like enzymes, receptor & ion pumps, give rise to oxidation, & hampering their usual action. Free radical causes damage to the cell structure & DNA. This is devastating to the cell. Among all, most active species is hydroxyl radicals. The mechanism of destruction of cell is as follows

- **Lipid Peroxidation:** Free radicals repeatedly attacked Poly unsaturated fatty acid (PUFA) of membrane, and produce very devastating PUFA radicals. It is called lipid peroxidation. Transition elements decayed this lipid peroxides and this Lipid peroxidation is spread to different area and produce extensive destruction of membrane and demolition of different structures with in cells.
- **Oxidation of Protein:** Free radicals produce cell injury by oxidation of large protein molecules of the cell, cross linking of labile amino acids and through fragmentation of polypeptides directly. Ultimately it produces destruction of proteases & damage of cells.
- **DNA Damage:** Free radicals cause breaks in the single strands of the nuclear & mitochondrial DNA. & produces cell injury; it may also cause malignant transformation of cells.
- **Cytoskeletal Damage:** Reactive oxygen species are also interact with cytoskeletal elements & obstruct the mitochondrial aerobic phosphorylation & thus cause ATP depletion.

This destruction of cell is represented as follows

- Free radicals are the main culprit in the aging process itself.
- The free radicals are highly reactive & sometimes the excessive amount of free radical can participate in unwanted side reaction resulting in cell injury & death & contributed many diseases. Scientists now believe that free radical are causal factors in nearly every known diseases & some of these as follows: Cancer, Stroke, Myocardial infarction, Diabetes, Atherosclerosis, Alcohol induced liver damage, Arthritis, Haemochromatosis, Skin pigmentary melanin abnormality, Senile & drug induced deafness, Immune system is also subject to free radical damage. Immune cell like T-cell, NK cell, T- helper cell can suffer from free radical damage.

Atherosclerosis ^[6, 7]

Definition: It is a specific form of arteriosclerosis affecting primarily the intima of large & medium sized muscular arteries & is characteristic by fibro fatty plaques or atheroma.

Development: The development of atherosclerosis is a multifactorial process, & importance of oxidative stress in the development of atherosclerosis seems to be widely accepted. Free radical are involve throughout the atherogenic process, beginning from endothelial dysfunction in another wise intact vessel wall, up to the rupture of a lipid rich atherosclerotic plaque. Mechanism of formation of atheroma as follows;

1. **Endothelial Injury:** Endothelial injury is initial requirement for the formation of fibro-fatty plaques. Baring of endothelium is not a necessary condition, but

for the initiation of the event, endothelial dysfunction is required. Risk factor such as oxidative stress, chronic hyperlipidaemia, hypertension, cigarette smoking, and haemodynamic forces can cause damage or dysfunction of endothelium.

2. **Oxidation of LDL:** Current studies advocate that oxidation of LDL is a significant factor. Oxidation of LDL modified by different cell like endothelial cell, smooth muscle cell, & macrophages which liberate reactive oxygen species (ROS) outside of the cell. Inside the LDL molecule, long-chain polyunsaturated fatty acid peroxidized that is initiate by Hydroxyl radical and produce conjugate dienes & lipid hydroperoxy radical. These process is self-propagating, so these radicals can assault neighboring fatty acid till total fragmentation of occur. After that numerous highly reactive products accumulate within LDL particle; including malondialdehyde & lysophosphatides. These products interact with the amino side chain of the Apo protein B 100 & form epitopes that are not recognized by the LDL receptor. Oxidised LDL also cytotoxic for endothelium.
3. **Role of Blood Monocyte:** Monocytes are attached to endothelium & moved into the sub endothelial space & differentiated into macrophages. Oxidised LDL helps in to proliferate & activate the monocyte.
4. **Formation of foam cell:** Sub endothelial macrophages take the oxidized LDL & then with in arterial intima they transformed into a "Foam Cell". After that LDL-loaded foam cell accumulates underneath the endothelium & formed "fatty streak". That is initial microscopic proof of the formation of the atherosclerotic plaques.
5. **Smooth Muscle Cell Proliferation:** TNF- α & IL-1 β obtain from monocyte leading to increase in number of smooth muscle cell, which is stimulated by oxidized LDL, which is also activated by different growth factor. It is occur along with production of collagen, elastin fibre protein & proteoglycans – called matrix protein. Elaboration of these proteins by smooth muscle cell laid the base for atheroma formation.
6. **Thrombus Formation:** Adhesion, clustering & a number of substance release from platelet occur due to injury of endothelial injury at the site of uncovered sub endothelial connective tissue. Synthesis of prostacyclin (an antiplatelet aggregation substance), is inhibited by lipid peroxide, which is responsible for adhesion & clustering of platelet. Aggregation of platelet laid the base for development of thrombus. Subsequently, growth factor release from platelet, leading to increase in number of smooth muscle cell & movement toward intima. This cause mild inflammation which along with foam cell is included into the atheromatous plaque. As the fibrin & blood cells attached to the lesion, it becomes enlarge so the thrombus becomes a part of plaque.

Effects are manifest as follows

- **Aorta:** Abnormal bulging in the wall, formation of blood clot & obstruction of the vessels.
- **Heart:** Heart attack, diminished blood flow due to atherosclerosis.
- **Brain:** Chronic ischemia of brain, Stroke, Ischemic Encephalopathy.

- **Intestine:** Decreased blood flow due to obstruction, Mesenteric occlusion.
- Peripheral vascular disease.

Management and Treatment Homoeopathic approach ^[5]

In the aphorism 3 of Organon of Medicine, Hahnemann said that a true practitioner must have — knowledge of the disease, indication, knowledge of medicinal power, choice of the remedy, the medicine indicated, & proper dose & approach to the every case should be holistic which depend upon the totality of the case. In aphorism 7 our master Hahnemann said that totality —“outwardly reflected picture of the internal essence of the disease, that is, of the affection of the vital force”, by which we can individualised the patient suffering from same nosological disease.

Some medicines are discussed below which present in most of the repertory under the rubric Atherosclerosis ^[1, 2, 3, 4, 8, 9]

1. Baryta Carbonica

- Suitable for the patient during first & second childhood.
- Mentally & physically dwarfism; stunted growth.
- Deficiency of memory; forgetful & inattentive; cannot be thought anything; idiotic vacant look.
- Great sensitive to cold; take cold easily.
- Sweat of foot is very much offensive; soreness of toes & soles.
- Haemorrhagic tendency in old people; headache of old people, who are foolish.
- Atrophy of cranial matter during old age.

2. Baryta Muriaticum

- Arteriosclerosis, systolic pressure is high with low diastolic pressure along with symptoms of heart & brain.
- Hypertension & vascular degeneration.
- Cardiac orifice becomes constricted & indurate with pain instantly after eating.

3. Benzoicum Acidum

- Adapted to gouty, rheumatic diathesis; gonorrhoeal or syphilitic patient.
- Nodosities; of joints.
- Urine dark brown, & the ruinous odor highly intensified.

4. Cactus Grandiflorus

- Contracted feeling in various parts of the body from slightest contact.
- Oppressed feeling of chest, as from a heavy weight; prevented normal motion.
- Palpitation: day & night; worse when walking & lying on left side.
- Headache, sensation of heavy weight; right sided headache & neuralgia; feeling of congestion; congestive, severe, throbbing, pulsating pain.

5. Calcarea Carbonica

- Leucophlegmatic; psoric constitution.
- Disposed to grow fat, corpulent, unwidely.
- Great liability to take cold. Coldness: general; of single part.
- Great longing for boiled egg, raw potato, craves

- indigestible thing; great aversion to meat & smoking.
- Profuse perspiration all over.

6. Conium Maculatum

- Suffering of old people; old bachelors with hard muscular fibre.
- Debility of old people.
- Vertigo especially when sleeping or from movement in bed; from slight movement of head or eyes; movements of towards left; of old persons.

7. Graphites

- It is useful for the obese woman, who suffers from constipation; menstruation delayed.
- Takes cold easily, sensitive to draft of air.
- Aversion to meat, sweet nauseates.

8. Lachesis mutus

- It affects mainly the left side of the body; symptoms go from left side to the right side of the body.
- Throat, stomach, abdomen are very much sensitive; Intolerance of tight band about neck or waist.
- Hot patient. Very sensitive to heat of sun.
- Haemorrhagic diathesis; blood dark, noncoagulable.
- All symptoms aggravated after sleep.
- Atheromatous condition of arteries; indurations of vein with cellular inflammation.

9. Lycopodium clavatum

- Predisposed to lung & hepatic affection. It mainly affects the right side of the body.
- Desire for sweet thing, hot food, like everything.
- Flatulence; appetite is fine, but feels bloated even after a little excess of food.
- Avaricious, greedy, miserly, malicious, pusillanimous.
- <Four to eight p.m. > from warm food & drink.

10. Plumbum Metallicum

- A great drug for general sclerotic condition.
- Hypertension & arteriosclerosis.
- Excessive & rapid emaciation.
- Cramp like constriction of peripheral arteries.
- Pulse soft & small, dichrotic. Wiry pulse.

11. Vanadium Metallicum

Atheroma of the arteries.

Dr. Burnett reports of having cured a case of fatty degeneration of liver & atheroma of arteries by Vanadium in a man of seventy.

Conclusion

The Purpose of this presentation is to create an awareness among ourselves to prevent & cure such disease wherever it possible, & as we all know that homoeopathy deals with the dynamic concept of the disease & so long the vital force of the individual is in the position to react synergistically with medicine, the chances of cure are possible, though homoeopathy has a restricted scope in advanced stage of the disease where there is a gross irreversible pathological change.

A symptomatic improvement in this type of incurable state by homoeopathic treatment is great achievement. Homoeopathy increases the internal resistance power & strengthens the vital force, so the quality & quantity of the

life can improve.

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