HYPOXIA THERAPY IN ANEMIA OF SICKLE CELL DISEASE THROUGH PRANAYAMA

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ABSTRACT
Sickle cell disease is a serious group of disease which are genetically affected. It affects the red blood cells, and RBC become sickle shape. Because of its shapes not able to carry the oxygen to the required area in the body results in chronic anemia. These sickle cells cause other problems in the body like often blocking blood flow and causing painful attacks and sometimes stroke. Stem cells are survives in the hypoxia. This is an attempt to review the effect of pranayama in increasing oxygen carrying capacity in anemia of sickle cell disease.

KEYWORDS: Sickle cell disease, Hypoxia, Pranayam.

INTRODUCTION
Sickle-cell disease (SCD) is a group of blood disorders typically inherited from a person's parents. It is a genetic disorder which causes the expression of defective hemoglobin resulting irregularly shaped red blood cells, known as “sickle cells.”[1] The most common type is known as sickle-cell anaemia (SCA) These sickle cells cause problems in the body, often blocking blood flow and causing painful attacks and sometimes stroke. It is a genetic disorder characterized by chronic anemia.[2]
The prevalence of SCD is over 72,000 Americans and millions throughout the world, most of African descent. Approximately near about 1 in 12 African Americans carry the trait for SCD and 1 of every 350 African-American infants born have the disorder and the incidence of the disorder in Africa is ten times higher.\[3]\]

Recently, it has been diagnosed that sickled red blood cells are more susceptible to oxidative changes than normal red blood cells and current treatments for SCD elicited on applying free radical chemistry to sickled cells. The goal is to create an effective life-long solution in order to improve the quality of life and decrease the mortality rate in affected populations.\[4]\]

SCA is an autosomal recessive inherited disease in which red blood cells become sickle-shaped. It is occurred by a single base substitution in the $\beta$-globin gene, which is situated on the short arm of chromosome. Finally valine is produced instead of glutamic acid causing the production of sickle hemoglobin (HbS). This results in the formation of an irregular shape of the erythrocytes. Due to this abnormal shape, small blood vessels can be blocked, causing serious damage to the bone, spleen and skin tissues. This may lead to episodes of pain, frequent infections, hand-foot syndrome or even multiple organ failure. The distorted erythrocytes are also more susceptible to hemolysis, which leads to serious anemia.\[5]\]

**Sign and symptom of sickle cell anemia**

The most common symptom of sickle cell disease is pain. During a crisis, pain may seem to come from the bones, usually in the arms, hands, legs, feet, or back. Also, there may be pain in the stomach or chest. Infection, Anemia (or a low blood count), Fatigue, "Acute Chest Syndrome" (severe chest pain with breathing difficulties), Eye problems such as bad eyesight and blindness, Brain damage or stroke.\[6]\]

Pranayama: Pranayama is science. It is the fourth Anga or limb of Ashtanga Yoga. “Tasmin Sati Svasa prasvasayorgatvicchedah Pranayamah”—Regulation of breath or the control of Prana is the stoppage of inhalation and exhalation, which follows after securing that steadiness of posture or seat, Asana. Thus is Pranayama defined in Patanjali Yoga Sutras.\[7]\n
In this article attempt is made to understand the effect of pranayama in increasing oxygen carrying capacity in anemia of sickle cell disease.
DISCUSSION
The scientists are trying to capture stem cells from the bone marrow, cultivate them, and then inject them at the site of desired organogenesis or organ repair. Why body can’t do it itself? What then prevents the bone marrow stem cells from circulating and relocating themselves to the place of need? – Oxygen.[8]

OBSERVATION
It is observed that Smokers have high hemoglobin, because Smoking is known cause of increase in hemoglobin (Hb) concentration that is believed to be mediated by exposure of carbonmonoxide. Carbonmonoxide binds to Hb to form carboxyhemoglobin, an inactive form of hemoglobin having no oxygen carrying capacity. Carboxyhemoglobin also shifts the Hb dissociation curve in the left side, resulting in a reduction in ability of Hb to deliver oxygen to the tissue. To compensate the decreased oxygen delivering capacity, smokers maintain a higher hemoglobin level than non-smokers.[9]

By above it is Inference that Hypoxia increases Hb. Pranayama is the one media inducing controlled self-administered Hypoxia in Sickle Cell Anemia.

Pranayama: The word Pranayama has been formed by the combination of two Sanskrit terms Prana and Ayama. The term Prana means breathing activity and Ayama means restrain, control or the conscious manipulation. Thus the pranayam means, the conscious manipulation of the breathing pattern makes it Dirgha i.e. deep and prolonged, and Sukshma i.e. extremely gentle and effortless, ultimately the whole process culminating in to complete silencing of the breathing activity itself.[10]

Anulome –vilome, kapalbhatti, Bhramari, Bhasrika, Ujjayi, Yog-Nidra, & Om jap are the pranayams. Before start one should practice the Pranayamic breath involves three phases of breathing i.e. inhalation, exhalation and retention and accordingly it has three basic components i.e

- Puraka – it is a phase of inhalation, controlled in yogic way.
- Rechaka – it is a phase of exhalation, controlled in a yogic way.
- Kumbhaka - it is a phase of retention, controlled in a yogic way.[11]
According to an estimate, our lungs take air in 180-200 cubic inches. When we inhale, we take in 30 cubic inches air and exhale the same amount. This is clear that around 150 cubic inches remains in the lungs all the time. If we take a deep long breath then we can inhale and exhale up to 100 cubic inches of air. With Pranayama, we can make major part of the air present in the lungs active in the breathing cycle. Humans take 15 breaths in a minute and by practicing Pranayama, they can increase the life span. Controlling the breath gives the ability to control the sensory organs, leads to intellectual and spiritual attainment.

Hypoxia: It is a stage in which the body or a region of the body is less supply of adequate oxygen supply at the tissue level. Generalized hypoxia occurs in healthy people when they ascend to high altitude. Where it causes altitude sickness leading to potentially fatal complications. Hypoxia also occurs in healthy individuals when breathing mixtures of gases with low oxygen content, e.g. while diving underwater especially when using closed-circuit rebreather systems that control.\[12\]

Hypoxia has been shown to increase hemoglobin levels through the formation of EPO. Hypoxia has been shown to increase resistance of tissues to various insults and injuries, including radiation injuries and aging.\[13\]

The Antar Prakash Centre for Yoga, Haridwar, have shown that Nisshesha rechaka, a type of Pranayama described in Hatha Pradeepika (H.P.) is the easiest way to produce brief, intermittent hypoxia. According to H.P., it can work on any organ on which the practitioner wants it to work by focusing the mind on that organ while performing the rechaka.\[14\]

The glycoprotein hormone erythropoietin (EPO) counteracts tissue hypoxia by increasing the systemic oxygen-carrying capacity. It induces augmentation of red blood cell mass by stimulating the formation and differentiation of erythroid precursor cells in the bone marrow. EPO production is increased under various forms of diminished oxygen supply such as anaemic or hypoxic hypoxia.\[15]\n
Stem cells only survive in hypoxia. Stem cells are abundant in foetal circulation where the partial pressure of oxygen (pO\textsubscript{2}) is low. They disappear from the circulation soon after birth. They survive in various locations (Niches) in the body in adulthood. A young individual has an abundance of these stem cells. Old age is when the stem cell population reduces. It is
possible that stem cells from the bone marrow migrate to various tissues, and such migration may be facilitated by even a few minutes of hypoxia every day.\[16\]

Hypoxia has been a frightening term for doctors and medical students because of the possibility of damage to cells, tissues and organs.\[17\] In India, yogic treatment of various diseases is common. A lesser known but important variety of Pranayama is ‘nisshesha rechaka’, which may be described as breath holding at residual volume.\[18\]

By the proper practicing the yoga and pranayam they stimulate the bone marrow. the stimulation of bone marrow the stem cell become trafficking and circulating peripheral in all over body and gives the healthy state of the various part of the body, it maintain the delayed wrinkle and aging, maintained the proper functioning of the liver, it increase the myokines secretion from muscles, it helps in the better function of the heart, it stimulates the pancreas for better secretion of insulin, it increase the lungs capacity, it reform the memory, concentration and intelligence and decrease the abdominal fat deposits as a result the human beings find the positive health.\[19\]

To perform daily the Nisshesha rechak that is daily brief hypoxia increase the erythropoietin and increase the haemoglobin level in the body even in patients suffering from chronic renal failure. Nisshesha rechak is increase the level of VEGF as a result coronary collaterals, it induction of low blood pressure, more perfusion and increase the erectile function, it favours the stem cell migration and prevent the disease of the osteoarthritis of the knees joints. It prevents the cancer in the body by induction of P53 the guardian of the genome, it delayed the effect of ageing by resistance to the cellular damage.\[20\]

Formation of RBC there by increased hb. Erythropoiesis is the process by which the origin, development and maturation of erythrocytes occur. Erythropoiesis occurs first in foetal life, than in postnatal life and in adults. The stem cells are the primitive cells in the bone marrow, which gives rise to the blood cells, as the stem cells can gives rise to different types of blood cells, these are called pluripotent hemopoietic stem cells. The process of erythropoiesis occurs in following stages like proerythroblast, early normoblast, intermediate normoblast, late normoblast, reticulocyte and matured erythrocyte.\[21\] Through pranayama stem cells may gets stimulated for the formation of healthy RBC, which will be have the oxygen carrying capacity.
CONCLUSION
Daily Self-Administered brief, intermittent hypoxia may help stem cell migration thereby improving Hb in Sickle cell Disease/ Sickle cell Anemia Pranayama; A natural Stem cell mobilization therapy without any adversities of medicine or surgery.

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