EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 4
Issue: 11
724-726
Year: 2017

# VARIATIONS OF RED BLOOD CELL INDICES IN SICKLE CELL ANEMIA W. S. R TO *PANDU*

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**Article Received on 10/09/2017** **Article Revised on 30/10/2017** **Article Accepted on 01/11/2017**

**ABSTRACT**
Sickle Cell Disease (SCD) is a most important and widely prevalent haemoglobinopathy which is due to the presence of Sickle Haemoglobin (Hb S) in Red Blood Cell. Red cell develops sickling when they are exposed to low oxygen tension. It is typically inherited from an individual's parent (autosomal recessive). This disease is characterised by chronic Haemolytic Anaemia. Changes in Red Blood Cells can be observed and interpreted from a well furnished report of Red Blood Cell Indices. Red Blood Cell indices include PCV, MCV, MCH, MCHC and RDW. Ayurveda texts has not explained Sickle Cell Disease directly, rather explained it as *Pandu Rog* with the symptoms like *Raktalpta* (low Haemoglobin), *Aruchi* (Anorexia), *Daurbalya* (debility), *Shwas* (Dyspnoea), *Jwar* (Fever), *Shoola* (Pain) etc. It can be correlated with Sickle Cell Anemia due to the fact that many of the symptoms that are mentioned in *Pandu Rog* are similar to the symptoms mentioned in sickle cell disease. Further in this Article variations of Red blood cells Indices in Sickle Cell Anaemia w.s.r to *Pandu* will be highlighted.

**KEYWORDS:** Sickle Cell Anaemia, Red Blood Cell indices, PCV, MCV, MCH, MCHC, RDW, *Pandu*, *Anuman Praman.*

## INTRODUCTION

Sickle cell Anemia is an inherited blood disorder (defective hemoglobin). Normal RBCs are smooth, disk-shaped and flexible, like doughnuts without holes and 7.2 µm in diameter, so they can move easily through the vessels & live up to 120 days. Sickle cell RBCs are stiff and sticky and form into the shape of a sickle or crescent, like the letter C, when they lose their Oxygen. These Sickle cells tend to cluster together and cannot easily move through the blood vessels & live about 10 to 20 days only. The cluster causes a blockage in small arteries or capillaries and stops the movement of healthy, normal oxygen carrying blood. This blockage is what causes the painful and damaging complications of sickle cell disease.

Red blood cell indices are blood tests that provide information about the hemoglobin content and size of red blood cells. Abnormal values indicate the presence of anemia and which type of anemia it is. Components which are - PCV (Packed cell volume / Hematocrit), MCV (Mean corpuscular volume), MCH (Mean corpuscular hemoglobin), MCHC (Mean corpuscular hemoglobin concentration) and RDW (Red blood cell distribution width).

Sickle cell Anemia is a condition where there will be *Vata-Pitta prakop & Kapha kshaya lakshanas*. Similar Pathology, signs & symptoms are observed in *Pandu roga*. Hence, It can be co-related with *Pandu roga.*

***Jatah pramehi madhumehino va na sadhya uktah sa hi bija doshat |***
***Ye cha api kechit kulaja vikara bhavanti tanscha pravadantaya asadhyan ||*** [1]
*Acharya Charak has* mentioned all hereditary diseases as incurable (*Asadhya*).There are 2 types of *Asadhya* like *Yapya & Pratyakhyeya*, Sickle Cell Anemia is a *Yapya Vyadhi.*

***Sa khalvapyo raso yakrut pleehanau prapya ragam upyaiti |***
***Rajjjit aste jasa twapah sharir sthen dehinam |***
***Avyapannah prasannen raktam etya bhidhiyate ||*** [2]
According to *Acharya Sushruta, Ahar paripak* produces *Rasa* which enters into Liver and Spleen, and gets

coloured by the process of *rajjit (Ranjak Pitta)*. It's known as *Rakta.*

***Vistrata dravata ragah spandanm laghuta tatha | Bhumiyadinam guna hi ate drashyante cha atra shonite ||*** [3]

According to *Acharya Sushruta* human blood is made up of five primordial elements, such as the Earth (*Pruthvi Mahabhuta*), Water (*Jala Mahabhuta)*, Fire (*Agni Mahabhuta)*, Air (*Vayu Mahabhuta)*, Ether (*Akash Mahabhuta)*, as all these attributes are present in the blood (Rakta) and comprised of features like fleshy odour (*vistrata*), fluidity (*dravata*), redness (*ragah*), movement (*spandanam*) and lightness (*laghuta*).

***Predanam jeevanam lepah sneho dharan purane | Garbhopadasch dhatunam shreshtham karm krumat smrutam ||*** [4]

*Acharya Vaghbhat* has mentioned in *Astang Hridaya Jeevanam* is the function of *Rakta*, but in the case of Sickle Cell Anemia, *Rakta* will not be able to carry its normal function of *Jeevanam*. It will circulate in the body, but due to its Sickle shape it gets obstructed which also suggests that oxygen carrying capacity reduces & symptoms like *Shwas, Daurbalyata, Shoola, Jwar* etc will originate.

*Acharya Sushrut* and other *acharyas* has described about *Vata dosha (Su.Sa. Sh- 2/37)*. On the bases of that *Vata* may break down the normal Red Blood Cells and convert them into abnormal shape, similar to a sickle or crescent.

In Sickle Cell Anemia, due to *kha-vaigunyata* which is possible due to bijadushti that person's normal Red Blood Cells will get converted into Sickle shape.

## AIM AND OBJECTIVES

To find out the variations of Red Blood Cells Indices in Sickle Cell Anemia.

To analyse the relation between Sickle Cell Anemia and *Pandu*.

## MATERIALS AND METHODS

*Charak samhita, Sushrut samhita, Madhav nidan*, Harrison's Principles of Internal Medicine, Davidson's Principle and Practice of Medicine and Google.com are referred for collection and compilation of Sickle Cell Anemia & *Pandu*.

## DISCUSSION

A complete blood count (CBC) / Haemogram is a blood test used to evaluate your overall health and detect a wide range of disorders, including Anemia, Infection and Leukemia. It measures several components and features of your blood, including: Hemoglobin (Hb) the oxygen-carrying protein in Red blood cells, White blood cells (WBCs) which fight infection, Red blood cells (RBCs) which carry oxygen, Hematocrit the proportion of Red blood cells to the fluid component or Plasma in your blood & Platelets which help with blood clotting.

**Variations of individual RBC's indices in sickle cell Anemia**

**PCV** - Packed cell volume / Hematocrit, PCV is the percentage of red blood cells in circulating blood. Interpretation -It will decrease in Sickle Cell Anemia due to haemolysis, either genetic defect or bone marrow defect.

**MCV** -Mean Corpuscular Volume, Which is the average Red Blood size. Interpretation -It will be within normal limit in Sickle Cell Anemia because of an increased production of HbS as seen in Sickle cell disease.

**MCH** - Mean Corpuscular Hemoglobin, Which is the amount of haemoglobin per Red Blood Cell. Interpretation -It will be also within normal limit or decrease in Sickle Cell Anemia because there are insufficient numbers of red blood cells.

**MCHC** - Mean Corpuscular Hemoglobin Concentration, Which is the amount of haemoglobin relative to the size of the cell and haemoglobin concentration per Red Blood Cell. Interpretation - MCHC can be elevated in hereditary spherocytosis, sickle cell disease and homozygous haemoglobin C disease, depending upon the hemocytometer. MCHC can be falsely elevated when there is agglutination of red cells It is used to help diagnose the type, cause and severity of Anemia.

**RDW** - Red blood cell distribution width, which measures the Red Blood Cells volume and size. Interpretation –It will also increase in Sickle Cell Anemia due to hemolysis, the abnormal breakdown of RBCs, either in blood vessels (intravascular hemolysis) or elsewhere in the human body (extravascular). RDW test determines the changes in the volume of the cells in the red cell population. The variations pertaining to the size of the red blood cells is called Anisocytosis and the shape is called Poikilocytosis.

***Sarva dravyam panchabhoutikam |*** [6]

According to *Acharya Charak*, all *Dravyas are Panchbhautik*. In Ayurveda *Pancha Mahabhutas* changes the R.B.C's shape with the help of Tridosha like -*Vata prakop* will originate the symptoms like Pain because of *Vayu* & *Akash Mahabhut* dominancy by the stimulation of *Kriyatmaka parivartan.*

*Pitta prakop* may destroys the R.B.C's or decrease the life span (10-20 days) of R.B.C's because of *Agni Mahabhuta* dominancy by the stimulation of *Ushmanikya parivartan*.

*Kapha kshaya* will instead cause *Vata* increase in *Shareera* which will help in sickling or changing the normal shape of R.B.Cs and become rigid by the stimulation of *Rachnatmaka parivartan*. This condition of *Kapha kshaya* will reduce flexibility of Red cell Hb, which may stuck in small pathways/capillaries

/microvasculature and will produce Haemolysis and Anemia which reducing blood flow in body parts which causes tissue, organ damage & bone disorders.

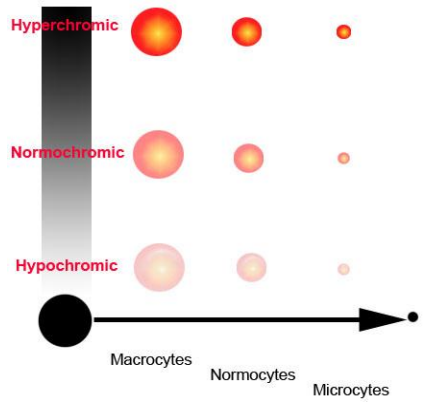
## CONCLUSIONS

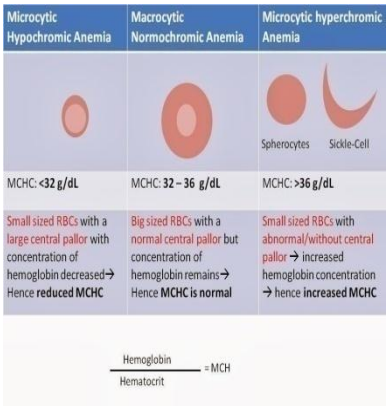
Approximately 5% of the world's population carries trait genes for haemoglobin disorders, mainly, Sickle-cell disease and thalassaemia. Over 2,50,000 babies are born annually with Sickle Cell Anemia worldwide. The 20 million people of India are known to suffer from sickle cell disease. The highest frequency of sickle cell gene in India is reported from Orissa, followed by Assam, Madhya Pradesh, Uttar Pradesh, Tamil Nadu and Gujarat. The average frequency of sickle gene is 4.3%, while that in Orissa is 9.1%. The population diversity of sickle cell haemoglobinopathy in India mainly is the result of the admixture of genes between different populations.

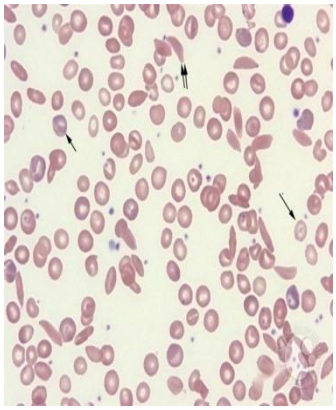
Elevated RDW, low PCV, normal MCV, normal / low MCH and increase MCHC indicate the Sickle Cell Disese. These RBCs Indices interpretations will make the provisional diagnosis for Sickle Cell Anemia. The result can be compared to RBC morphology on a peripheral blood Smear to confirm the diagnosis.

In Ayurveda Panchamahabhutas changes the shape and qualities of the Red Cells with the help of *Tridosha*. *Vata prakop* will originate the symptoms like Pain, *Pitta prakop* may destroys the R.B.C's or decrease the life span (10-20 days) of R.B.C's & *Kapha kshaya* will reduce flexibility of Red cell Hb, which may stuck in blood vessels and will produce Haemolysis and Anemia,.

Healthy RBC's which may converted into Sickling shape, we can compare with the conditions like *Vata Pitta prakop* and *Kapha kshayaj Pandu*.



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