

A REVIEW ON RANJAKA PITTA WITH SPECIAL REFERENCE TO ERYTHROPOIESIS

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Abstract: Body is made up of three basic elements that is *vata*, *pitta* and *kapha* they remains constant from birth till death. Among these three *doshas*, *pitta dosha* is the entity which is mainly responsible for transformation. *Ranjaka* pitta one of the subtypes of *pitta* which is mainly located in stomach, liver and spleen with respect to its function related to coloring the *rasa* and also takes part in *Raktothpatti*. *Haritha* clearly explains the seven stages of *Raktotpatti* and color changes during the stage of transformation of *rasa* to *Rakta*. Erythropoiesis is a stage where uncommitted pluripotent hematopoietic stem cells get origin development and maturation. the factors responsible for erythropoiesis are presented in stomach liver like intrinsic factor of castle, vitamin B12, iron etc. Hence here we can establish the relationship between the function of *Ranjaka* pitta and the factors responsible for erythropoiesis.

Keywords: *pitta*, *Ranjaka pitta*, Erythropoiesis, Transformation,

Introduction:

Ayurveda the ancient science which is mainly based on *Tridosha Siddhantha* .

The

Tridosha that is *Vata*, *Pitta*, and *Kapha* are associated with the human body right from the time of fertilization of the ovum till the death¹. All physiological functions are performed

by *Tridosha* when they are in normal state. In the vitiated state they pollute the whole body and responsible for disease production². *vata pitta* and *kapha* are direct responsible for causation of *vyadhi* and also for *swasthya*, are the causes of production, preservation and destruction of the body. They pervade

the whole body, but their special seats in the normal state are lower, middle and upper portions of the body respectively³. Like how the pillars support the house similarly these *Tridoshas* supports the *Sharira*, The second among the *Dosha* triad, i.e. Pitta, represents all the agents that are responsible for the transformations taking place in the living system. Changes taking place during digestion, metabolism, maturation and the homeostasis – all these are under the control of Pitta *dosha*.

Pitta dosha: The word "Pitta" is derived from the word "Tapa" indicated the meaning "heat". Hence it represents heat (*agni*) in the body. *Pitta* is originated from the combination of "Teja" and "apa" *mahabhuta*. Pitta because of this combination acts as active energy element in the body which brings about physio-chemical action in the cell or tissue and facilitates the process of digestion in the body in the G.I.T. and in the tissue level is governed by *Pitta* itself⁴.

Guna karma of Pitta: *Pitta* is having *tiksna*, *ushna*, *sara*, *drava*, *laghu*, *snigdha*, etc. properties which are

responsible for biochemical changes at the level of cells and tissue. *Teja mahabhuta* is dominant it leads to upward movement, if *ap mahabhuta* is dominant it move down wards in direction. *Pitta* maintains digestion, thirst, appetite energy production and body temperature, color, complexion.⁵ There are 5 types of *pitta*, *Pachaka*, *Ranjaka*, *Brajaka*, *Alochaka* and *Sadhaka pitta*, subtypes of *pitta* gives a direction of view towards distribution of its functions, *pitta* has its representation in different places of the *shareera*, classification can be understood in terms of functional distribution of *pitta*. one among such is *ranjaka pitta*.

Ranjaka pitta :

Nirukti Sthana And Karma of *ranjaka pitta* :

रंजयति इति रंजकः । (शब्दकल्पद्रुम)

Derived from the root word "रञ्ज्", the one which imparts colour is called *ranjaka*, *yakruth* and *pleha* are the *sthana* according to *sushruta* and *vagbata* and *sharangadhara* opines *amashaya*⁶. The major function of *Ranjaka pitta* is to impart red colour to the *rasa* to form *Rakta*. According to *Kedarakulyanyaya* of *Dhatuparinama*,

the nutrients specific to *Raktadhatu* are transported to the liver and spleen, synthesized by the *Raktadathvagni* to form the *Raktadhatu*. Hence, *Raktadathvagni* and *Ranjakapitta* are two entities responsible for the formation of *Raktadhatu*⁷.

Rakta Datu Nirukthi and Guna : root *raja ranjane* means to stain, since the *datus* is red colour it is called *rakta*, if white cloth is stained with this *rakta* it becomes red colour, *rakta* is *raga kruth*.

Rakta Pramana : that is 8 *anjali pramana*⁸

Raktadara Kala: *kala* is a thin membrane, which lining the internal cavity of the *ashayas*, organs, blood vessels and fibrous capsule of the joints. The *kala* separates *datu* and *ashayas*. Among *saptadara kala raktadara kala* is explained in the second hierarchy. *Raktadara kala* is the lining internally of the blood vessels, internal aspects of the liver and spleen, the thin membrane lies in between the lobule of the spleen and liver. The tunic intima of the blood vessels is *raktadara kala*⁹. *Sharangadhara* mentioned *Pleeha* and *Yakrut* as 4th *kala*

Utpatti of Raktha: *Rakta* is produced in the *raktavaha strotas*, it get generated in intrauterine life, growth and nourishment by food just like other *dathu's*. When some amount of *rasa dathu* reaches the next *strotas* that is *raktavaha strotas*, there *rasa* is converted to *rakta* with the help of *ranjaka pitta*. *Rakta* is formed from *rasa Dathu*, *Rasa* while travelling through the *Sthana* i.e. *Yakrit* and *Pleeha* imparts red color and *Rakta* is formed, *Charaka* observed that from *Ahara Rasa*, *Rakta Dhatwagni* absorb more *Agneya Amsa* and transform into *Rakta*. it is clearly mentioned that *Rakta* is formed by the *Usma* of the *Pitta* which renders the *Rasa* into a colored state. This is a general view put forward for the *Rakta* formation. After the period of *Caraka*, *Sushruta* says the *Rakta* is formed in *Yakrt* and *Pleeha* with the help of *Ranjakagni*. that *apa Rasa* when circulates through *Yakrt* and *Pleeha* it becomes coloured there and thus *Rakta* is formed, *Astanga Hridaya, vagbatta* has mentioned that *Rakta* forming factor i.e. *Ranjaka Pitta* is also formed in *Amasaya*, From this all information's and references it is inferred that *Usma*

of the *Pitta* and *Rasa* are the main factors by which *Rakta* is formed and secondary *Yakrt*, *Pleeha* and *Amasaya* are the organs in which this process is taking place¹⁰.

Factors which play major role in the formation of *Rakta dhatu*:

Poshaka dravya of *rakta dhatu*, *rakta vaha srotas*, *raktadhara kala*, *sarakta meda*, *ranjaka pitta*, *rakta dhatwagni*.

Method of *Rakta* Formation:

1. *Suksma Bhaga*
2. *Sthula Bhaga*
3. *Mala Bhaga*¹¹

Sargadhara Samhita (Deepika commentary) says *Varnaparivartana*, stages of formation of *Rakta Dhatu*, *Rakta* is formed in seven days by gradual change taking place in its color *Varnaparivartana*

1. *Sweta*
2. *Kapota*
3. *Haridra*
4. *Padma*
5. *Kimsuka*
6. *Alaktaka*
7. *Rasaprakhyal/indragopa*

Erythropoiesis: Erythropoiesis is the process of origin, development and maturation of erythrocytes¹².

Site of Erythropoiesis:

- During intrauterine life
- ✓ Mesoblastic stage (3rd week to 3 months)
- ✓ Hepatic stage (after 3 months)

- ✓ Myeloid stage (3rd trimester)
- In children
- ✓ All bones with red bone marrow
- ✓ Liver & spleen
- In adults (after 20yrs)
- ✓ Ends of long bones like femur, humerus
- ✓ Skull
- ✓ Vertebrae
- ✓ Ribs
- ✓ Sternum
- ✓ pelvis

Stages of Erythropoiesis¹³:

1. Pronormoblast
2. Early normoblast (Basophilic)
3. Intermediate normoblast (Polychromatic)
4. Late normoblast (orthochromatic)
5. Reticulocyte.
6. Matured RBC

• Stem Cells¹⁴

These cells have extensive proliferative capacity, Ability to give rise to new stem cells (**Self Renewal**), Ability to differentiate into any blood cells lines (**Pluripotency**), Hematopoietic stem cells (HSCs) are bone marrow cells that are capable of producing all types of blood cells. They differentiate into one or another type of committed stem cells (progenitor cells).

- **Progenitor cells**

Committed stem cells lose their capacity for self-renewal. They become irreversibly committed. These cells are termed as "Progenitor cells". They form CFU-E

- **Proerythroblast**

The first cell derived from CFU-E, It is very large in size 20 μ , Larger nucleus, Two or more nucleoli and a reticular network, Cytoplasm is basophilic in nature

- **Early Normoblast**

Slight reduction in size 14-17 μ , Large nucleus, nucleoli reduce in number, Basophilic cytoplasm, Active mitosis.

- **Intermediate Normoblast**

Cell size 10-15 μ size, Nucleus is still present. 'POLYCHROMASIA', Nucleus condenses Chromatin lumps, Hb starts appearing, Reduced mitoses

- **Late Normoblast**

cell diameter decreases to 8-10 μ , nucleus becomes ink spot nucleus, cytoplasm becomes almost acidophilic, the process by which nucleus disappears is called pyknosis

- **Reticulocyte**

Young erythrocytes with granular or reticular filamentous structures. Makes up 0.5-2% of all erythrocytes, Vital

staining required to make this visible. Has no nucleus, has no organelles, is larger than the mature RBC, is not concave, has many polyribosomes. In severe anemia, many of these are released into the blood prematurely \rightarrow Reticulocyte response. Normally 1% of circulating blood, are reticulocytes.

- **Mature erythrocyte**

Reddish, circular, biconcave cells, Cell size 7-8 μ . No visible internal structure. High Hb content, Bright at center due to biconcave shape changes during erythropoiesis, decrease in size, loss of mitotic activity (later part of intermediate normoblast). Hemoglobinization (intermediate normoblast), change of cell shape (from globular to biconcave) disappearance of nucleus, mitochondria, RNA, etc change of staining (basophilic – eosinophilic)

Factors Necessary for Erythropoiesis¹⁵

- General factors.
- Special maturation factors.
- Haemoglobinization factors.

General Factors:

- Optimum levels Erythropoietin
- Mechanism controlling erythropoietin.

Special Maturation Factors:

- Vit B 12 (extrinsic factor)
- Folic acid
- Intrinsic factor of Castle.

Vit B 12 (Extrinsic Factor)

- Daily need – 1-2 µg.
- Sources – Milk, Meat, Liver of Animals
- Also synthesized by bacterial Flora.
- Absorption – need Intrinsic Factor Of Castle , a glycoprotein secreted by parietal cells of gastric mucosa.
- With it form Intrinsic Factor-Cyanocobalamin complex
- Bound to sp receptors in ileum & absorbed by Endocytosis.
- Storage – In liver & Muscle
- Role – required for synthesis of DNA & maturation of nucleus & cell.

Folic Acid:

- Daily requirement –
- 100 µg.
- Sources – leafy veg, pulses, yeasts, liver.
- From breakdown of Polyglutamate to Monoglutamates¹⁶.

Intrinsic Factor of Castle:

- Intrinsic factor of Castle is formed by Gastric Cells.
- Deficiency if intrinsic factor occurs in autoimmune cause of failure of secretion of IF. (Pernicious Anemia)

Fate of RBC: After 120 days the membrane of RBC becomes fragile and gets rupture in spleen, then it gets divided into heme and globin, globin is reused and from heme iron is reused and bilirubin pigment is formed, this bilirubin is released in to blood as free bilirubin, with in few hours after entering in to circulation it is taken up by the liver cells. In liver it is conjugated excreted in to intestine through bile¹⁷.

Discussion: *Ranjaka Pitta* and *Rakta Dhatwagni* are the two entities essential for the formation of *Rakta*. *Rakta Dhatwagni* synthesizes cellular components other than what imparts red colour to blood. *Ranjaka Pitta* supply coloring materials simultaneously in it and thus formation of *Rakta* is completed. This can be related to heme synthesis in particular. So *Ranjaka Pitta* involves the activity of *Pitta* necessary for the formation of RBC. The quality of rasa depends on the *Ahara* i.e -Proteins, metals and vitamins. Iron and its metabolism should be specifically considered (factors essential for Hb synthesis). Function of *Ranjaka Pitta* is to absorb iron i e, in GIT (*Amasaya-*

intrinsic factor of castle), transport and storage of iron (liver & reticulo endothelial cells) The areas *Amasaya*, *Yakrit* and *Pleeha* thus became predominant areas of activity of *Ranjaka Pitta*. But when it comes to *Raktagni* it synthesizes cellular components other than what imparts red colour to blood. This includes formation of WBC's, platelets, etc. All these don't contribute to '*Ragatvam*' in *Raktha*. They have dissimilar functions too. When *Raktha Dhathu* is considered '*Jeevana*' is given as its important function. This function is solely attributed to RBC's and to Hb. But WBC function includes protective and defensive function whereas in case of platelets it is clotting mechanism. So it is related more to *Bala*, *Vyadikshamatva*. Even if we notice the changes during erythropoiesis, four important changes are noticed as Reduction in size of cell, Disappearances of nucleoli & nucleus, Appearances of hemoglobin, Change in the staining property of cytoplasm.

Conclusion:

The prominent seats for the functioning of *Ranjaka Pitta* are *Yakrit*,

Pleeha and *Amasaya*. *Ranjaka Pitta* and *Rakta Dhatvagni* function with mutual assistance .Since *Ranjaka Pitta* encompasses a wide range of bodily function, the factors that influence *Ranjaka Pitta* is also not single. Steps and duration in *Raktotpatti* and steps and duration of formation of RBC (erythropoiesis) can be correlated, *Ranjaka pitta* status can be assumed by Hb % and RBC count. The *Ranjaka pitta* function could be summarized as transformative principle necessary for haemoglobin formation, erythropoiesis and factors influencing iron metabolism. With the aid of contemporary science the *Sthanas* of *Ranjaka pitta* as *Amashaya*, *Yakrit* and *Pleeha* can be substantiated.

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