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 Raktothpatti 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 death. 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 production. 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 respectively\(^3\). 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 “apä’ 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 facilities the process of digestion in the body in the G.I.T. and in the tissue level is governed by Pitta itself\(^4\).

**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 “रञ्जः, the one which imparts colour is called ranjaka, yakruth and pleha are the sthana according to sushrutha 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 entites responsible for the formation of Raktadhatu.

**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.

**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 seperates datu and ashayas. Among saptadara kala raktadara kala is explained in the second hierarchy. Raktadara kala is the liningening 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.

**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 place.\(^{10}\)

**Factors which play major role in the formation of Raktha 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. Rasaparakhyal indragopa

**Erythropoiesis:** Erythropoiesis is the process of origin, development and maturation of erythrocytes.\(^{12}\)

**Site of Erythropoiesis:**

- **During intrauterine life**
  - Mesoblastic stage (3rd week to 3 months)
  - Hepatic stage (after 3 months)
- **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 Erythropoiesis**\(^{13}\):

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

**Stem Cells**\(^{14}\)

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

• **Intermediate Normoblast**
  Cell size 10-15µ, 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 → 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 Erythropoiesis**

- 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 Monoglutamates\(^\text{16}\).

**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 bile\(^\text{17}\).

**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, Vyadikshamata. 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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