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Iron Deficiency Anemia W.S.R Panduroga In The Pediatric Age Group: A Comprehensive Overview

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Abstract: In developing countries like India, nutritional deficiency is one of the major reasons behind many diseases, especially among children. A large part of the Indian population lives below the poverty line and is unable to afford a well-balanced diet that includes important food items like milk, cereals, pulses, and green leafy vegetables. As a result, many Indian children suffer from nutritional deficiency disorders,the most common being Iron Deficiency Anaemia (IDA). According to the World Health Organization (WHO), over 2 million children around the world are anaemic, and about half of them suffer specifically from iron deficiency anaemia.In Ayurveda, this condition can be correlated with Pandu Roga, which is described in classical texts based on similar signs and symptoms. Ayurveda explains that Pandu Roga occurs due to the loss of the body's vital essence, known as Ojas, which is responsible for strength-bala, varna, sneha. When Ojas is reduced, it leads to low blood formation (alpa rakta), poor nourishment (alpa meda), and fatigue (nissara). This further results in *indriya shaithilya*, and *vivarnata*. The main goal of treatment in Ayurveda is to correct and balance especially a white skin tone known as pandu varn and their related symptoms. *Dhatvagni* and *Jatharagni* are responsible for proper metabolism in body. When Agni is properly balanced, the metabolism functions normally, and the body is better able to digest food, absorb nutrients, and maintain good health. This article explores the condition systematically, covering epidemiology, etiology, clinical features, diagnosis, management, and preventive strategies. Early intervention, dietary supplementation, and community programs are emphasized as critical measures to combat its impact.

Keywords: Iron Deficiency Anemia, Panduroga, Pediatrics, Hemoglobin, Nutritional Deficiency

Introduction:

Pandu Roga is a disease that has been described in Ayurveda since ancient times, with its earliest references found in the Vedas. In the Rigveda and Atharvaveda, this disease was referred to as Vilohita, Halima, and Harima. In Sushruta Samhita, it is also called Panaki, Laghavaka, and Kumbhahwa. The main feature of Pandu Roga is a change in the skin color. This is why it is called a *Varnopalakshita Roga*, meaning a disease that shows its signs through changes in body color. Ancient Ayurvedic texts describe the skin color in Pandu Roga as a pale white. Acharya Charaka mentioned that before the full development of the disease, a person may feel palpitations (Hridayspandan), dryness of skin (Twaksputan) and mouth, lack of sweating, and

general weakness or tiredness. Once the disease becomes more noticeable, symptoms may include pale eyes, loss of appetite, periorbital swelling, Tinnitus, and tiredness. Because of this overall paleness (panduta) in the body, Pandu Roga is very similar to anemia in modern medicine. Anemia is defined as a condition where the hemoglobin level is lower than normal for the child's age and gender. The most common reason for anemia in children is iron deficiency, which prevents the body from making enough healthy red blood cells. It is a major problem in infants and growing children. In developing countries like India, many children are affected due to poverty, poor hygiene, malnutrition, and repeated infections or parasites. Studies show that around 39% of children under 5 years and 48% of children aged 5 to 14 years are anaemic in such countries. In Ayurveda, Pandu Roga is considered a Pitta-dominant disease and mainly involves the Mamsa dhatu and Rakta dhatu. The disease usually begins when a person eats food that increases Pitta dosha. These disturbed doshas then affect the *Twak* and muscles *Mamsa*, causing the pale or yellowish skin color seen in Pandu.

The root cause of this disease in Ayurveda is Agnimandya. When digestion becomes weak, the body cannot digest, and absorb nutrients. This leads to the formation of immature body tissues, resulting in malnutrition,weakness and paleness. Iron Deficiency Anemia is the most prevalent nutritional disorder globally, and especially in India. According to the National Family Health Survey (NFHS-5, 2019–21), 67.1% of children are anemic in India. The prevalence is higher in rural areas due to factors like poor diet, parasitic infections, and inadequate iron supplementation.

सर्वेषु चैतेष्विह पाण्डुभावो यतोऽधिकोऽतः खलु पाण्डुरोगः ॥ (सु.उ.त. 44/6)

" According to Sushrut Samhita, when the pallor becomes predominant, it is called Paṇḍuroga.

Aim and Objective:

- To study the etiopathogenesis of panduroga from ayurveda and modern perspective.
- To highlight the intervention of panduroga from ayurvedic perspective.

Materials and Methods:

Ayurvedic Samhita and its relevant books have reffered to collect the material for the article. Text of modern pediatrics by Nelson and Op Ghai also reffered to collect material for article.

Epidemiology:

- **Global Prevalence**: According to the World Health Organization (WHO), approximately 42% of children under 5 years of age worldwide are affected by anemia, with iron deficiency being the primary cause. IDA accounts for about 50–60% of all anemia cases in children globally.
- **Regional Data**:South Asia and Sub-Saharan Africa bear the highest burden of pediatric IDA.
- **India** (NFHS-5, 2019–21): 67.1% of children aged 6–59 months are anemic
- In the **United States**, approximately 8–10% of toddlers aged 1–3 years are iron-deficient, with higher rates in low-income, immigrant, and minority groups

Etiology:

क्षाराम्ललवणात्युष्ण विरुध्दासात्म्यभोजनात्।

निष्पावमाषपिण्याकतिलतैलनिषेवणात्।

विदग्धेऽन्नेदिवास्वप्नात् व्यायामन्मैथुनात्तथा।

प्रतिकर्मर्तुवैषम्याद् वेगानां च विधारणात्।

कामचिन्ताभयक्रोधशोकोपहतचेतसः । (च.चि. १६/५-७)

The *ksara*, *amla*, *lavaṇa*, and *atyuṣṇa* foods, along with *viruddha* and *asatmya* diets, leads to disturbance of digestion and metabolism. *Nishpav, masha, pinyak*, and *tila taila*, which impair the *agni* (*Jatharagni*) and cause accumulation of *ama*. *vidagdha anna*, *divaswapna, vyayama, maithuna* weaken body tissues and

disturb the natural balance of doshas. *pratikarma, ṛutu vaiṣhamya*, and suppression of natural urges like urination or defecation (*vega dharan*) also contribute to doshic imbalance. *Kama, chinta , bhaya, krodha*,which disturb the mental state (*chetas*) and impair the physiological functioning of the body. These emotional disturbances weaken the digestion and metabolism, ultimately affecting *rakta dhatu* . These substances aggravate doshas, particularly *Pitta* and *Kapha*, leading to poor *rakta dhatu* formation.

MODERN VIEW:

- Premature infants, low birth weight infants or infants with perinatal blood loss, early cord clamping.
- Excessive consumption of cow milk (low iron content, blood loss from milk protein colitis) in a child who is often overweight or bottle feeding beyond 12 month of age.
- Worldwide, Undernutrition is usually responsible for iron deficiency.
- Blood loss including menstrual losses , recurrent nosebleeds or intravascular hemolysis with hemoglobinuria, as seen in disease such as malaria.
- Unrecognized blood loss also can be associated with chronic diarrhea and rarely, with pulmonary hemosiderosis.
- Chronic iron deficiency anemia from occult bleeding may be caused by a lesion of the gastrointestinal tract such as peptic ulcers, Meckel diverticulam , polyp, hemangioma or inflammatory bowel disease.
- Chronic infections: Hookworms, Trichuris trichuria , Plasmodium, Helicobacter pylori often contribute to iron deficiency.

AYURVEDIC PATHOPHYSIOLOGY:

Ahitkar Ahara and *Vihar* results in *Pitta* dosh prakop. The *prakupit pitta* dosh enters into *Yakrut.*As *yakrut* is the mulasthana of *Raktavaha Srotas* ,and *Ras dhatu* converted into *Rakta dhatu* with the help of *Ranjak pitta* in *Yakrut*. In *Yakrut,* due to the dushti of *Raktagni* and *Ranjaka Pitta*, leading to *Rakta Kshaya*.The *Prakupit Pitta* then enters the *Hridaya* and spreads throughout the body via *Dashadhatuvahini Dhamani*, thereby affecting all Dhatus. Especially, *Sadhaka Pitta dushti* in the *hriday* , leading to improper *Dhatu Utpatti*, causing loss of Bala, Varna, Sneha, and Ojas. The entire body becomes *Nissara*, and especially *Rakta* and *Meda* Dhatu *Kshaya*, ultimately resulting in *Vaivarnya* and signs of Pandu Roga.

MODERN PATHOPHYSIOLOGY:

First, tissue iron stores are depleted. This depletion is reflected by reduced serum ferritin, an iron-storage protein, which provides an estimate of body iron stores in the absence of inflammatory disease. Next, serum iron levels decrease, the iron-binding capacity of the serum (serum transferrin) increases, and the transferrin saturation falls below normal. As iron stores decrease, iron becomes unavailable to complex with protoporphyrin to form heme. Free erythrocyte protoporphyrins accumulate, and hemoglobin synthesis is impaired. At this point, iron deficiency progresses to iron-deficiency anemia.

Prodromal Symptoms:

- त्वक्स्फोटनष्ठीवनगात्रसाद मृद्भक्षणप्रेक्षणकूटशोथः ।

  विण्मूत्रपीतत्वमथाविपाको भविष्यतस्तस्य पुरःसराणि ॥ - (मा.नि.पाण्डु/३)

  Skin eruptions (Tvak sphoṭana), excessive spitting (ṣṭhivana), fatigue (gatrasada), eating mud (mṛudbhakṣaṇa), and periorbital swelling (akshikuṭashotha), yellow discoloration of stool and urine (viṇmutra-pitatvam), and indigestion (avipaka) these are the prodromal symptoms Paṇḍuroga."

Common Symptoms:

- सम्भूतेऽस्मिन् भवेत्सर्वः कर्णक्ष्वेडी हतानलः । दुर्बलः सदनोऽन्नद्वीट् श्रमभ्रमनीपिडितः॥

गात्रशूलज्वरासगौरवार्बुचिमान्नरः । मुदितैरीव गात्रैश्चपीडितोन्मथितैरिव ॥ शूनाक्षिकूटोहरितः शीर्णलोमाहतप्रभः । कोपनः शिशिरद्वेषी निद्रालुः ष्टीवनोऽल्पवाक् ।भवन्त्यारोहणायासैः विशेषश्चास्य वक्षते ॥ (च.चि.१६/११-१४)

Karnakṣveḍ (Tinnitus) ,*Hatanalaḥ (agnimandya)* ,*Daurbalaya,Angasadh(* Fatigue*),Annadveṣha, Shrama, bhrama, Gatra shula , Jvara, gauravaḥ, akṣikuṭaḥ shoth (* Periorbital swelling),*Haritaḥ* (Yellowish-green pallor of the skin),*Sirṇalomaḥ*(Hair loss), *Ahataprabhaḥ (*Diminished glow of the body*) ,Kopanaḥ(Irritability) ,Shisir dweshi (Dislikes cold), NidraluṢṭivanha* (Frequent spitting), *Alpavak*(Reduced speech) are above the symptoms of panduroga. *Arohanasya*(Shortness of breath especially on exertion, and complains of chest discomfort).

All above the symptoms *Panduta,Akshikutashotha and hridayspandan* this three are the major symptoms in panduroga.

In Modern view:

- Pallor (pandutva) (not visible until the hemoglobin falls to 7-8 gm/dl)
- Cold intolerance, fatigue, excersise induced dyspnea or decreased mental acuity.
- Mild to moderate anemia (Hb- 6 to 10 gm/dl) mild irritability noted.
- Hb level falls to < 5 gm/dl some symptoms like anorexia,lethargy,and systolic murmurs are often heard. If the Hb levels continuously falls tachycardia and high output cardiac failure.
- Some symptoms include seizures, breath holding spells,restless legs syndrome in adults.
- Other nonhematologic consequences of iron deficiency include **pica,pagophagia**(the desire to ingest ice)
- Delayed developmental milestones

Similarities between Iron deficiency anemia and Pandurog:

Sr .no	Signs and Symptoms of IDA	Signs & Symptoms of Pandu
1	Fatigue	Gaurav, Gatrasaad
2	Breathlessness on exertion	Arohanyasa , swasa
3	Headache	Shiroruja
4	Palpitation	Hridayspandan
5	Dizziness	Bhrama
6	Pica	Mritbhakshana
7	Irritability	Kopan
8	Anorexia	Aruchi
9	Growth retardation	Dhatu shaithilya
10	Edema	Shoon Akshi koota , shopha

Diagnosis:

- **Laboratory Investigations: Normal mean and lower limits of normal for HB, PCV, MCV.**

Age (year)	Hemoglobin (gm/dl)		Hematocrit%		Mcv(uM3)	
	mean	Lower limit	mean	Lower limit	mean	Lower limit
0.5 to 1.9	12.5	11.0	37	33	77	70
2 to 4	12.5	11.0	38	34	79	73
5 to 7	13	11.5	39	35	81	75
8 to 11	13.5	12.0	40	36	83	76
12 to 14 (female)	13.5	12.0	41	36	85	78
12 to 14 (male)	14	12.5	43	37	84	77

  - Serum Ferritin: <12 ng/mL indicates depleted iron stores.

WHO classification of Anemia (Hb – Gm/dl) according to age and severity:

Population	Non-Anemia	* Mild Anemia	*Moderate Anemia	*Severe Anemia
• 6-59 months of age	≥ 11	10-10.9	7-9.9	<7
• 5-11 years of age	≥ 11.5	11-11.4	8-10.9	<8
• 12-14 years of age	≥ 12	11-11.9	8-10.9	<8
• Non-pregnant women	≥ 12	11-11.9	8-10.9	<8
• Pregnant women	≥11	10-10.9	7-9.9	<7
• Men (≥ 15 years)	≥13	11-12.9	8-10.9	<8

Pandu roga complications (Upadrav) :

- Aruchi (loss of taste)
- Pipasa (Excessive thirst)
- Chardi (Vomitting)
- Jwara (Fever)
- Moordha ruja (Headache)
- Agnisad
- Kanta shopha (swelling of the neck)
- Abalatwa (loss of strength)
- Moorcha (Blackouts)
- Hridhyavapeedana (Chest tightness)

Chikitsa Sidhdhant :

तत्र पाण्ड्वामयी स्निग्धस्तीक्ष्णैरूध्वानुलोमिकैः ।

यथादोषं विशिष्टं च तयोर्भेषज्यमाचरेत्। । (च. चि 16/40)

In Paṇḍuroga, medications should be *snigdha, tikṣṇa, and anulomana* , according to the specific dominance of doshas (Vata, Pitta, Kapha).

पञ्चगव्यं महातिक्तं कल्याणकमथापि वा ।

स्नेहनार्थं घृतं दद्यात् कामलापाण्डुरोगिणे। । (च. चि. 16/42-43)

For a patient suffering Paṇḍuroga (anemia), *Panchagavya ghṛita, Mahatikta ghṛita, or Kalyanaka ghṛita* should be given for snehana.

वातिके स्नेहभूयिष्ठ, पैत्तिके तिक्तशीतलम् ॥

शलेष्मिके कटुतिक्तोष्णं, विमिश्र सान्निपातिके। (च. चि 16/116-117)

- In Vataja Paṇḍu use snehana medications.
- In Pittaja Paṇḍu, use *tikta* and *shita* (cold) medications.
- In Kaphaja Paṇḍu, use *katu*(pungent), tikta (bitter), and *ushna* (hot substances).
- In Sannipataja panduroga mixed dosha type of combination therapy accordingly use.

MODERN VIEW:

- **Oral Iron Therapy:** Ferrous sulfate, gluconate, or fumarate, adjusted per age and severity.

  Dose – 3 -6 mg/kg of elemental iron in 1 to 2 divided doses. (Max dose – 150-200mg / Day)

- **Dietary Interventions:** Iron-rich foods such as green leafy vegetables, meats, legumes, and fortified cereals.
- **Severe Anemia:** Parenteral iron therapy or blood transfusion in critical cases.

TIME AFTER IRON ADMINISTRATION:

12-24 hr -Replacement of intracellular iron enzymes,subjective improvement, decreased irritability, increased appetite; increased serum iron

36-48 hr -Initial bone marrow response, erythroid hyperplasia

48-72 hr -Reticulocytosis, peaking at 5-7 days

4-30 days -Increase in hemoglobin level, increase in mean corpuscular volume; increase in ferritin

1-3 month -Repletion of stores. The Hemoglobin will then begin to increase 0.1 to 0.4 gm/dl/day depending on the severity of anemia.

Prevention:

- Breastfeeding should be encouraged, with the addition of supplemental iron at 4 month of age.
- Infants who are not breastfeed should only receive iron fortified formula (12 mg iron/L) for the first year and therafter cow`s milk should be limited to < 20-24 oz daily.
- Routine screening of all children using hemoglobin or hematocrit is at done at age 9-12 month or earlier.
- Fortification of staple foods with iron.
- Maternal nutrition during pregnancy and lactation.
- Timely introduction of complementary foods.
- Dietary counselling (Excessive intake of milk, particularly cow milk should be limited)

Discussion:

Iron deficiency anemia (IDA) in children is multifactorial, influenced by nutritional, infectious, and socio-economic factors. While modern medicine provides effective treatment protocols, traditional approaches like Ayurveda offer complementary options worth exploring. Public health strategies, including education, food fortification, and regular health check-ups, are essential to address the root causes of IDA.

Conclusion:

Iron deficiency Anemia is a preventable condition that requires a multi-pronged approach for effective management. Collaboration among healthcare providers, policymakers, educators, and families is vital to ensure the well-being and development of affected children. With timely interventions and public health initiatives, the burden of IDA can be significantly reduced.

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