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Pathogenesis of Vitiligo (Switra) – An Ayurvedic Understanding

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Abstract: Switra, described in Ayurveda, is a skin disorder characterized by depigmented patches, which can be correlated with vitiligo in modern medicine. This condition results from the loss of melanocytes and is influenced by factors such as improper diet, genetic predisposition, stress, and environmental triggers. Ayurveda explains the pathogenesis of Switra as a derangement of the body's doshas, particularly Pitta, which affects metabolism and complexion. The disease can be categorized into three types based on severity, and deeper involvement of tissues indicates a poor prognosis. Modern scientific research suggests that vitiligo arises from multifactorial causes, including autoimmune mechanisms, oxidative stress, neural factors, genetic predisposition, and environmental triggers. The autoimmune hypothesis, which involves the destruction of melanocytes by T-cell-mediated cytotoxicity, is the most widely accepted. Additional theories suggest oxidative damage, neural disruptions, and inflammatory processes contribute to the disease. In Ayurveda, Switra's pathogenesis involves the accumulation of Ama due to deranged Jatharagni and the vitiation of Tridosha (Vata, Pitta, Kapha), which disrupts skin pigmentation. The role of Bhrajaka Pitta, responsible for skin color, is diminished in vitiligo, and the imbalance in Vata and Kapha exacerbates melanocyte damage. The interplay of genetic factors, autoimmune responses, oxidative stress, and doshic imbalances leads to the characteristic depigmented lesions observed in vitiligo. Understanding these mechanisms can aid in developing more effective treatment and prevention strategies.

Keywords: Pathogenesis of vitiligo, Switra samprapthi, Bhrajaka Pitta.

INTRODUCTION

Switra is a skin disorder described in Ayurveda as a condition characterized by depigmented patches on the skin, can be correlated to Vitiligo in modern medicine which results from the loss of melanin. Switra primarily affects the skin's complexion, leading to white or lighter patches. Ayurveda considers multiple causative factors such as intake of unwholesome food, genetic predisposition, excessive exposure to heat, suppression of natural urges, doing exercise without considering the time and duration, sleeping during day time, telling lies, thanklessness, insulting elders, bad deeds of past, excessive consumption of new rice, curd, fish, black gram, sesame, milk, jiggery and processed food stuffs.[1] These factors lead to the imbalance of Doshas in body and mind. Doshic derangement is lead by Pitta Dosha, which governs the body's metabolism, transformation processes and responsible for body complexion. Describing the prognosis it is said that if the disease is located in deeper dhatus it is difficult to cure.[2] Ayurveda mainly describes 3 types of Switra based on colour and increasing severity viz. Rakta, Tamra and Switra depending on the residing dhatu Rakta, Mamsa and Meda respectively.[3] Switra lesion which presents as overlapped, numerous, occurring on genitals, palm,

soles, present since many years and if body hairs are involved are said to be incurable. Thus, understanding the proper pathogenesis (Samprapti) of Switra plays a pivotal role in the determination of success of treatment. In present work an attempt is made to uncover the possible facets involved in the manifestation of Switra (Vitiligo).

Pathogenesis of Vitiligo

Vitiligo is a chronic, acquired skin disorder characterized by the progressive loss of melanocytes, leading to depigmented macules and patches. The exact pathogenesis of vitiligo remains complex and multifactorial, involving genetic, autoimmune, neural, and environmental factors. Several interrelated hypotheses have been proposed to explain the destruction of melanocytes, including the autoimmune hypothesis, oxidative stress hypothesis, neural hypothesis, genetic predisposition, and melanocyte detachment theory.

Autoimmune Mechanism: The most accepted theory in pathogenesis of vitiligo is the autoimmune hypothesis, which indicates an abnormal immune response leading to the destruction of melanocytes. Presence of autoantibodies and T-cell-mediated cytotoxicity against melanocytes seen in vitiligo patients give evedences in this regard. Studies have found elevated levels of CD8+ T cells that specifically target melanocytes, leading to their apoptosis. Vitiligo is also seen associated with other autoimmune disorders such as thyroiditis, rheumatoid arthritis, and type 1 diabetes mellitus in the patients or family members support its autoimmune basis. Genetic studies have identified polymorphisms in immune-related genes, including HLA, PTPN22, and CTLA-4, which are linked to increased susceptibility to autoimmune diseases, including vitilig.[4]

Oxidative Stress Mechanism: In patients of vitiligo, high sensitivity of melenocytes to oxidative stress has been observed; which are attributed to defective antioxidant mechanism in them. Reactive oxygen species (ROS) accumulate in skin due to various physical factors like exposure to UV rays, irritant chemicals and psychological factors like emotional disturbances, sleeplessness etc. these accumulated ROS cause oxidative damage to melenocytes and lead to their dysfunction and apoptosis. Decreased activity of antioxidant enzymes like catalase and glutathione peroxidase are identified in vitiligo patients.[5]

Neural Mechanism: This hypothesis is based on the fact that many vitiligo lesions follow dermatomal pattern of distribution. This suggests that nerve endings present at the site of vitiligo lesions when triggered by stressors, secrete unusual amount of neurotransmitters like norepinephrine which may contribute for the abnormal functioning of melanocytes or melanocyte destruction itself. Abnormal functioning of nerves also sometimes interferes with process of pigmentation like melanosome migration and contributes in the pathogenesis of vitiligo.[6]

Genetic Factors: It is observed that, significant proportion of patients suffering from vitiligo indicate some sort of genetic predisposition towards vitiligo or other autoimmune disorders. Vitiligo is believed to exhibits a complex polygenic inheritance pattern, which is suggested by the studies indicating that individuals with a first-degree relative affected by vitiligo have a higher risk of developing vitiligo. Recent genome associated studies have identified susceptibility genes like NLRP1, TYR, and PTPN22, which believed to be involved in regulation of immunity, functioning of melenocytes, and apoptosis. No single gene is identified to be responsible for the causation of vitiligo, but it is indicative that the interaction between environmental and genetic factors contributes to the onset and progress of vitiligo.[7]

Inflammatory and Cytokine-Mediated Mechanisms: Melanocyte destruction is also believed to be associated with a process of inflammation. Increased levels of Cytokines and other inflammatory mediators like tumour necrosis factor- alpha (TNF- α), interferon- gamma (IFN-γ) and interleukin-17 (IL-17) have been found in the lesions of vitiligo. These cytokines contribute to immune mediated destruction of melanocytes by upregulating T-cell activation and apoptosis.[8]

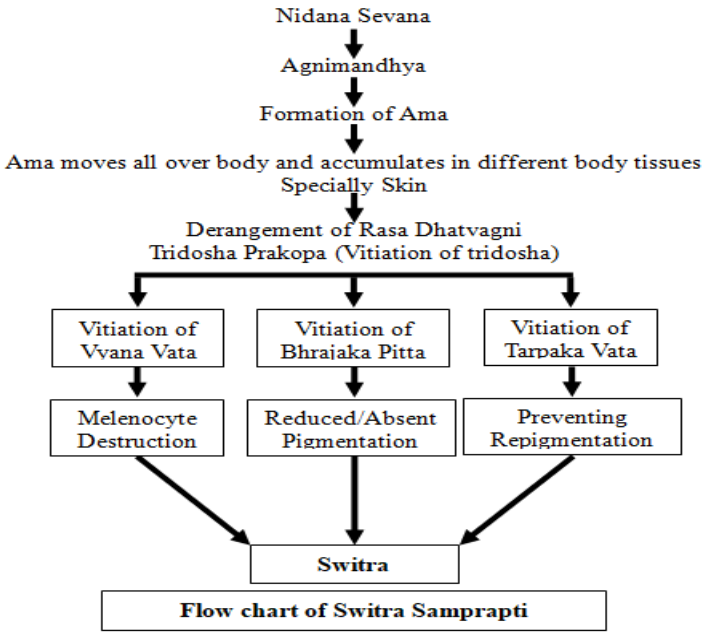
Role of Environmental Triggers: Environmental triggers such as exposure to physical trauma like friction, corrosive chemicals and infections are linked to the onset and progression of vitiligo.

Psychological stress also has a significant role in immune dysregulation and induction oxidative damage to melanocyte.[9]

In Ayurveda, the pathogenesis of Switra (vitiligo) can be understood as follows. When a person consumes or indulges in causative factors it leads to derangement of Jatharagni which produces Ama (improperly formed metabolites) which circulates throughout the body and gets lodged in different tissues including skin. This accumulated ama in the skin interferes with the functions of rasa dhatvagni and leads to the vitiation of Tridosha viz. Vyana Vata, Bhrajaka Pitta and Tarpaka Kapha at the level of skin. Bhrajaka Pitta which plays a pivotal role in the formation and maintenance of body complexion, when vitiated leads to the reduction or absence of pigmentation. Vitiated VyanaVata and TarpakaKapha increases the morbidity of Switra by enhancing melenocyte damage and preventing the process of regimentation respectively.[10]

DISCUSSION and CONCLUSION:

Vitiligo is a chronic depigmentating skin disorder with a complex pathogenesis involving genetic susceptibility, autoimmune destruction of melanocytes, oxidative damage, and neural factors along with physical- psychological and environmental triggers. This is evidenced by the description of nidana of Kushta and Switra such as environmental triggers (excessive exposure to heat, suppression of natural urges, doing excersice without considering the time and duration, sleeping during day time), genetic predisposition, Psychological triggers (telling lies, thanklessness, insulting elders, bad deeds of past), auto immunity (intake of unwholesome food, excessive consumption of new rice, curd, fish, black gram, sesame, milk, jiggery and processed food stuffs) in treatices of Ayurveda. The interplay of these factors results in leading to characteristic depigmented lesions, which imply a reduced action of Bhrajaka Pitta. This depigmentation is due to multiple mechanisms involving Jatharagni, Ama, Bhrajaka Pitta, Vyana Vata and Tarpaka Kapha. Agnimandhya and formation of Ama at the level of Jatharagni and Rasa Dhatvagni lays the foundation for the cascade of pathogenesis of Switra. The role of pitta is conspicuous when there are inflammatory mediators and cytokine associated damage of one of the abode of Bhrajaka Pitta i.e. melonocytes. Melenocyte damage due to the defect in genetic composition, reactive oxygen species and neuro transmitters indicate towards the increase of stressors and vitiation of Vata Dosha. The role of Kapha Dosha in the causation and progress of depigmentation occurs when there is a blockage of normal cascade of pigmentation. Such instances are seen when there is Avarana of vitiated Kapha causing hindrance to conversion of thyrosine to Dopa and Dopaquinone due to lack enzymes or presence of enzyme inhibition. Pathologies such as obstruction to the migration of melanosomes to the periphery of the epidermis is also due to the Avarana of vitiated Tarpaka Kapha.



Flow chart of Switra Samprapti

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