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Review Article

Review on Vitiligo Beyond the Skin– A Journey of Strength and Self - Acceptance

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ABSTRACT

In this article, I aim to discuss autoimmune diseases, with a particular focus on vitiligo, as its prevalence among young individuals appears to be increasing in recent years.” Vitiligo is a chronic autoimmune disease. The body's immune system mistakenly destroys melanocytes, the cells that produce melanin (skin pigment) this leads to the white patches seen on the skin. It can appear anywhere on the body but it most commonly affects:- face, lips, hand, arms and feet, elbows, knees and joints scalp (may cause white or grey hair patches), genital area and mucous membranes. It does not cause physical pain or illness, but it can affect appearance and leads to psychological distress because of visible changes. In our country, India, where brown and other medium skin tones are common, vitiligo patches are more noticeable because of the contrast between the white patches and the natural skin color. The people with disease like vitiligo not only suffer from the physical or medical problems caused by their condition, but they also face social and emotional problems such as:- people treat them unfairly or differently because of how they look, they may be avoided or left alone by others due to fear or stigma and the people think vitiligo is contagious, a punishment, or caused by bad deeds. This article aims to create awareness about the disease vitiligo. And focuses on how genetic mutations and hereditary factors contribute to the development and progression of vitiligo, etiology, epidemiology and selfcare tips and “we would like to propose that the government initiate awareness campaigns on vitiligo to educate the public, reduce social stigma, and promote early diagnosis and treatment.”

INTRODUCTION

Epidemiology of Vitiligo

Vitiligo is a common depigmenting skin disorder that affects people of all races, genders, and ages worldwide. The global prevalence is estimated to be around 0.5% to 2% of the population. Both males and females are affected equally, although

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women may seek treatment more often because of cosmetic and social concerns. The disease can begin at any age, but most cases appear before the age of 30.

Vitiligo occurs in all ethnic groups, but it is more noticeable in darker skin tones, such as those common in India and other tropical countries, due to the sharp contrast between the depigmented and normal skin. Studies suggest that around 1% of the Indian population is affected, though the actual number may be higher because many cases go unreported.

A family history of vitiligo or other autoimmune diseases is seen in about 20– 30% of patients, indicating a strong genetic predisposition. Environmental triggers such as stress, skin injury, and chemical exposure can influence its onset and progression. Vitiligo is not contagious, but its visible nature often leads to social stigma and

emotional stress, particularly in regions where skin color differences are more noticeable.

Etiology

- 1.Genetic factors
- 2.Autoimmune Hypotheses
- 3.Oxidation stress Hypotheses
- 4.Neurogenic Hypotheses
- 5.Environmental and chemical factors

Introduction

Vitiligo is an autoimmune skin disorder characterized by white patches of skin losing functional melanocytes, the pigment-producing cells of the skin. Vitiligo is a common skin disorder with an incidence rate of 0.1-2% worldwide, and it has no sex bias Vitiligo has a significant impact on patients' quality of life and self-esteem and predisposes them to an increased risk of sunburn and skin cancer:

Types of vitiligo

Types	Distribution	symmetry	progression	Common Associations
Nonsegmental (NSV) / generalized vitiligo (most common (8590% of cases)	Widespread	Symmetrical	Slow, may spread	Autoimmune diseases
Segmental vitiligo(SV) Less common (about 10-15% of cases)	Localized (one side)	Asymmetrical	Rapid, then stable	Rearly autoimmune
Mixed	Both segmental & generalized	Both	Variable	-
Focal	One or few patches	Asymmetrical	May stabilize or spread	-

Melanin

1. Melanin is a natural pigment produced by specialized skin cells called melanocytes.



2. It gives color to the skin, hair, and eyes and also protects the skin from harmful ultraviolet (UV) radiation from the sun.
3. Melanin is formed inside melanocytes within special organelles called melanosomes from the amino acid tyrosine, through a process called melanogenesis.

Types of Melanin

1. Eumelanin Brown to black pigment. Found in skin, hair, and eyes.
2. Pheomelanin Yellow to reddish pigment Found in lips, red hair, and some skin regions.
3. Neuromelanin Dark pigment in certain brain regions Found in the Substantianigra and locus coeruleus of the brain.

Role of Melanin in the Skin

- * Gives skin its color
- * Absorbs UV radiation
- * Protects against skin cancer by reducing UV-induced mutations.
- * Acts as an antioxidant to neutralize free radicals.

Role of Melanin in Vitiligo

- * In vitiligo, there is loss or destruction of melanocytes, which means melanin production stops in those skin areas
- * The affected skin loses its color (appears white or depigmented).
- * The hair in those patches can also turn white.
- * The reason melanocytes die is due to autoimmune destruction, oxidative stress, or genetic predisposition.
- * Without melanocytes, melanin cannot be synthesized, leading to loss of pigmentation.

Explanation

1. Genetic Factors

- * **Family history:** About **30%** of patients have a family member with vitiligo. * Certain genes increase susceptibility - mainly genes that regulate the **immune system** and **melanocyte function**.
- * Examples:
- * **NLRP1, PTPN22, HLA genes, TYR (tyrosinase).**
- * This is called **genetic predisposition**, meaning a person is born with genes that make them more likely to develop vitiligo, especially if triggered by environmental or immune factors.

[1. Vitiligo sometimes it can come from parents, **but not always**. It happens

Because of genes that you may get from your mother or father. Lets say:- Mother as vitiligo:- She passes down genes that affect hore the immune system controls melanocytes.

If we grow up and face stress, or our skin cells get damaged, those genes may become active and vitiligo patches may appear. But if you don't face those criggers (Emotional stress, and sun burn, chemical exposure) you might never develop vitiligo, even though you carry those jenes]

[**Example:-2** If both parents have vitiligo – there is a higher chance that the Child may develop vitiligo, but it is not 100% sure.

*Vitiligo has a genetic link, which means certain genes that increase the risk can be passed to the child

* If both parents have those genes, the child has a greater chance of inheriting them.

* However, genes alone don't cause vitiligo — the disease usually appears only when



environmental or immune triggers act on those genes.]

***If one parent has vitiligo - the child risk is around 5-10%.**

***If both parents have vitiligo - the child risk is around 20-25%, but still not all Children get it.**

***[Protective jenes:-** some children inherit protective jenes from grand parents

Or the other side of the family. These reduce the risk – even men parents have

Vitiligo. It appears only when something activates.]

[*Impunity Differences:- Every person's immune system works a little differently.

Even with the same genes, one child's immunity may stay balanced, while another's may become overactive and attack color cells.

That's why even among twins, one can have vitiligo and the other may not.

Genes involved in vitiligo:-

Genes Involved In Vitiligo	
1. NLRP1 (NOD-like receptor family, pyrin domain containing 1)	<ul style="list-style-type: none"> • Function: Regulates immune and inflammatory responses. • Effect: Mutation causes abnormal immune attack on melanocytes.
2. PTPN22 (Protein tyrosine phosphatase non-receptor type 22)	<ul style="list-style-type: none"> • Function: Controls immune cell activation. • Effect: Variants increase autoimmune susceptibility.
3. TYR (Tyrosinase)	<ul style="list-style-type: none"> • Function: Key enzyme in melanin synthesis. • Effect: Certain variants make melanocytes immune targets.
4. HLA Genes (Human Leukocyte Antigen complex)	<ul style="list-style-type: none"> • Function: Present antigens to immune cells. • Effect: HLA-A2, HLA-DR4 linked with higher vitiligo risk.
5. CAT (Catalase)	<ul style="list-style-type: none"> • Function: Protects cells from oxidative stress. • Effect: Reduced catalase → oxidative damage to melanocytes.
6. MIF (Macrophage Migration Inhibitory Factor)	<ul style="list-style-type: none"> • Function: Regulates inflammation and immune responses. • Effect: Overexpression leads to melanocyte destruction.
7. FOXP3 (Forkhead Box P3)	<ul style="list-style-type: none"> • Function: Maintains immune tolerance via T-reg cells. • Effect: Mutation causes loss of tolerance, autoimmunity.
8. IL2RA & IL10 (Interleukin genes)	<ul style="list-style-type: none"> • Function: Regulate immune signaling and inflammation. • Effect: Variants promote abnormal immune responses.
9. XBP1 (X-box Binding Protein 1)	

<ul style="list-style-type: none"> • Function: Responds to cellular stress and immune activity. • Effect: Variant increases autoimmune melanocyte damage.
<p>10. GZMB (Granzyme B)</p> <ul style="list-style-type: none"> • Function: Enzyme that induces cell death via cytotoxic T cells. • Effect: Overactive GZMB directly destroys melanocytes.

2.Autoimmune Hypothesis

This is the most accepted theory:-

*1.The immune system mistakenly identifies melanocytes as foreign.

*Cytotoxic T cells(CD8) and autoantibodies attack and destroy melanocytes.

*Auttoantigens like tyrosinase and melan-A are targeted.

*Local inflammation leads to futher cells destruction.

2.Evidence Supporting Autoimmune Role:-

- * Association with other autoimmune diseases,e.g.:
- * Autoimmune thyroid disease (Hashimoto's, Graves')
- * Type 1 diabetes mellitus
- * Addison's disease
- * Alopecia areata

3.Oxidative stress Hypothesis: -

* Melanocytes in vitiligo patients are more sensitive to oxidative stress.

*Reactive oxygen species (ROS) such as hydrogen peroxide (H₂O₂) accumulate due to:

*Environmental stress (UV exposure, chemicals).

*ROS damage melanocytes – lipid peroxidation, DNA damage, and apoptosis.

*Damaged melanocytes release danger signals (DAMPs).

*These activate local immune responses – linking oxidative stress with autoimmunity.

4.Neurogenic Hypothesis:-

*Excess norepinephrine or dopamine may be toxic to melanocytes or inhibit melanin synthesis.

*Nerve injury or local neurochemical imbalance may cause localized melanocyte destruction.

5.Environmental and chemical factors:-

* Environmental triggers can induce or worsen vitiligo in genetically predisposed individuals.

Example:-

*Phenolic compounds (e.g., monobenzyl ether of hydroquinone, catechols) found in:

Rubber, adhesives, dyes, and cosmetics.

*Physical trauma or friction new lesions appear on injured skin.

* Sunburn, emotional stress, or infections can precipitate onset. These agents may directly damage melanocytes or mimic tyrosine, leading to cytotoxic effects and autoimmune activation.

Challenges faced by vitiligo people: -

1. Photosensitivity: -

The depigmented (white) patches lack melanin, which normally protects the skin from UV radiation. This causes:

Easy sunburns

Pain or irritation when exposed to sunlight

Skin peeling or redness in affected areas

2. Higher Risk of Skin Damage:-

Without melanin, the skin becomes more prone to tanning unevenly or developing sun-related skin conditions, including:

Freckles

Actinic keratosis

Rarely, skin cancer (melanoma risk increases slightly)

3. Changes in Hair Pigmentation: -

If vitiligo affects hair follicles, white or grey hair can appear early in the scalp, eyebrows, eyelashes, or beard areas.

This can make the condition more visible and lead to psychological distress.

4. Dryness and Sensitivity: -

The depigmented skin areas may become dry, scaly, or itchy, especially when exposed to harsh weather or cosmetic products.

Some people report burning or irritation after using certain topical creams.

5. Eye or Ear Involvement (Rare): -

Melanocytes are also present in the retina (eye) and inner ear. In rare cases, vitiligo can cause:

Inflammation in the eye (uveitis)

Mild hearing changes (sensorineural hearing loss)

6. Association with Other Autoimmune: -

- * Disorders
- * Vitiligo is an autoimmune condition, so some patients may have or develop:
 - * Thyroid disorders (hypothyroidism or hyperthyroidism)
 - * Type 1 diabetes
 - * Pernicious anemia
 - * Alopecia areata

7. Educational Barrier:-

*In some schools or colleges, students with vitiligo may face bullying, teasing, Or social rejection due to visible white patches.

*This can lead to embarrassment, low self-esteem, or withdrawal from social activities, which affects their concentration and participation in class.

8. Avoidance of Outdoor Activities

*Because of photosensitivity, some students avoid sports, physical education, or outdoor events in school/college to prevent sunburns or further skin damage.

*This may limit their participation in extracurricular learning opportunities.

Self-Care Tips for Individuals with Vitiligo:-

***Protect the skin from sunlight** – Use a broad-spectrum sunscreen (SPF 30 or higher), wear

protective clothing, and avoid excessive sun exposure to prevent burns on depigmented areas.

***Moisturize regularly** – Apply gentle, fragrance-free moisturizers to reduce dryness, irritation, and itching.

***Avoid skin injuries** – Cuts, burns, or friction can trigger new patches (Koebner phenomenon), so handle the skin gently.

***Use prescribed medications correctly** – Apply topical corticosteroids, calcineurin inhibitors, or other treatments exactly as directed by the dermatologist.

***Eat a balanced diet** – Include foods rich in antioxidants (vitamin C, vitamin E, zinc, and folic acid) to support skin health.

***Avoid harsh chemicals and cosmetics** – Choose mild, hypoallergenic skincare and hair products to prevent irritation.

***Manage stress** – Practice relaxation techniques such as yoga, meditation, or breathing exercises, as stress may worsen vitiligo.

***Seek emotional support** – Join vitiligo support groups or counseling programs to maintain confidence and positive mental health.

***Regular follow-ups** – Visit the dermatologist periodically to monitor progress and update treatment as needed.

Prevention Strategies for Vitiligo:-

***Protect skin from trauma and injury** – Avoid cuts, burns, and friction, as these can trigger new depigmented patches (Koebner phenomenon).

***Limit sun exposure** – Use broad-spectrum sunscreen, wear protective clothing, and avoid

prolonged exposure to strong sunlight to prevent skin damage.

***Manage stress effectively** – Practice relaxation methods such as meditation, yoga, or breathing exercises, since emotional stress can worsen vitiligo. ***Avoid harsh chemicals** – Stay away from bleaching agents, strong detergents, and hair dyes that may irritate or damage the skin.

***Maintain a healthy diet** – Consume foods rich in antioxidants (vitamins A, C, E, zinc, and folate) to support melanocyte function and skin protection. ***Treat associated autoimmune conditions** – Regular medical check-ups help detect and manage thyroid or other autoimmune disorders that can contribute to vitiligo.

***Avoid self-medication** – Always use dermatologist-prescribed creams or therapies to prevent side effects or worsening of lesions.

***Adopt healthy lifestyle habits** – Adequate sleep, hydration, and avoidance of smoking or alcohol can help in maintaining skin health and overall immunity.

Awareness camps on vitiligo

Awareness camps on vitiligo play a vital role in educating the community about the nature of the disease, emphasizing that it is not contagious and can be effectively managed with proper treatment and care. These camps aim to dispel myths, reduce social stigma, and promote empathy toward individuals living with vitiligo. They also provide guidance on available medical treatments, skincare practices, and the importance of psychological support to boost selfconfidence and mental well-being. By spreading accurate information and encouraging inclusivity, such initiatives help create a more understanding and supportive society for people with vitiligo.



Annual Check-up

People with vitiligo should undergo regular annual check-ups to monitor disease progression, evaluate treatment response, and identify any associated autoimmune or metabolic disorders. During the yearly visit, dermatological assessment is done to document any new or enlarging depigmented patches. Blood tests may be performed to screen for thyroid disorders, diabetes, pernicious anemia, and other autoimmune conditions, which are more common in vitiligo patients.

The doctor also reviews current medications, phototherapy outcomes, and provides guidance on sun protection, nutritional support, and mental health care. Regular follow-ups help in early detection of complications and in maintaining optimal skin and emotional well-being. The dermatologist may also review the patient's life style, dietary habits and stress levels, as these factors can affect disease activity. Annual check-ups serve as an opportunity for early detection of complications, adjustment of treatment plans and reinforcement of self-care practices.

CONCLUSION

Vitiligo is a multifactorial autoimmune skin disorder that arises due to the complex interaction of genetic, immunological, oxidative, neurogenic, and environmental factors. The loss of melanocytes leads to depigmented white patches on the skin, often resulting in psychological distress and social stigma, even though the disease itself causes no physical harm or pain. Understanding the underlying mechanisms—such as autoimmune destruction of melanocytes, oxidative stress, and genetic predisposition—helps in early diagnosis, effective management, and prevention of disease progression.

Comprehensive care for vitiligo extends beyond medical treatment; it includes emotional support, self-care practices, and awareness initiatives that promote acceptance and reduce misconceptions about the condition. By fostering public awareness, encouraging healthy lifestyle habits, and providing accessible dermatological care, society can help individuals with vitiligo lead confident, fulfilling lives free from discrimination or fear. Ultimately, compassion, education, and scientific advancement together can transform vitiligo from a misunderstood disorder into a well-managed and socially accepted condition.

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