Hair Health Issues: A Comprehensive Guide To Disorder And Solution

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Abstract: This article outlines various hair disorders, classifying them into categories such as hair loss disorders, scalp issues, hair structure problems, and infectious diseases affecting hair. It delves into the root causes of these conditions, which include genetic predispositions, hormonal changes, autoimmune disorders, and environmental factors. The text identifies prevalent disorders like androgenetic alopecia, alopecia areata, telogen effluvium, dandruff, seborrheic dermatitis, and psoriasis, while discussing their underlying mechanisms and effects on individuals. Treatment approaches, such as topical solutions like minoxidil, alpha reductase inhibitors, low-level laser therapy, and antifungal or anti-inflammatory medications, are explored. The article highlights the significance of early detection and tailored treatment strategies to relieve symptoms, encourage hair regrowth, and enhance overall quality of life.

Keywords: Hair disorder, Hair loss, Scalp issues, Alopecia, Minoxidil, Psoriasis

INTRODUCTION

A hair disorder is any condition in which the visible hair coverage over the skin falls outside of normal hair growth parameters. Hair disorders are not directly life threatening, although they can be a symptom of a more serious condition. Hair problems could be a sign of toxin exposure, hormonal imbalances from tumors, or inflammation like in systemic lupus erythematosus. [1]

Types of hair diseases:

A) Hair Loss Disorders:
- Androgenetic Alopecia (Male/Female Pattern Baldness)
- Alopecia Areata
- Telogen Effluvium

B) Scalp Disorders
- Dandruff (Seborrheic Dermatitis)
- Psoriasis
- Eczema (Atopic Dermatitis)

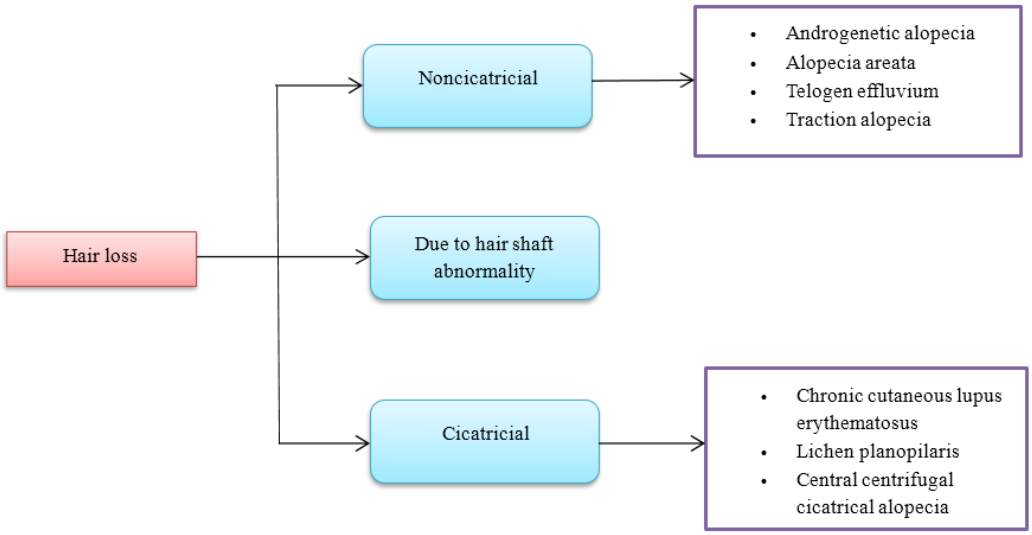
C) Hair Structure Disorders
- Brittle Hair Syndrome (Trichothiodystrophy)
- Split Ends
- Trichorrhexis Nodosa

D) Infectious Hair Diseases
- Head Lice (Pediculosis)
- Pubic Lice (Crab Lice)
- Ringworm of the Scalp (Tinea Capitis)

A) Hair Loss Disorders:

Hair loss, also known as alopecia, is a common problem seen in dermatology clinics. It can be caused by different factors and has a big impact on how people feel about themselves. [2] Hair loss is a common issue for women and can cause a lot of emotional distress. The first step in diagnosing hair loss is to determine if the hair density is normal or decreased and if the hair loss is happening during the growth or resting phase of the hair cycle. Anagen hair loss is severe and caused by diseases that stop hair follicles from growing, while telogen hair loss is milder and caused by factors that make hair follicles enter the resting phase early, leading to shedding after three months. [3]

Alopecia is split into two main groups: cicatricial and non-cicatricial. With cicatricial alopecia, hair follicles can be lost, leading to permanent hair loss. Non-cicatricial alopecia, on the other hand, is usually reversible. There are several reasons that can lead to non-scarring hair loss, such as emotional problems, ongoing health issues, not eating a balanced diet, lack of certain nutrients, and not having enough vitamins. Stress, using certain medications, problems with the immune system, hormonal imbalances, and changes in genes and how they are expressed can also contribute to this type of hair loss. [2]



1) Androgenetic Alopecia:

Androgenetic alopecia, also known as pattern hair loss, is a common type of hair loss

where hair follicles gradually become less effective or stop working altogether. It is the most common form of hair loss in both men and women. In men, it is called male pattern hair loss, and in women, it is known as female pattern hair loss. [4] It is a condition that is influenced by multiple genes and can vary in how severe it is, when it starts, and where on the scalp the hair loss happens. In men, hair loss usually happens on the sides and top of the head, while the back of the head is usually not affected, creating a horseshoe pattern. The chances of getting androgenetic alopecia depend on how old you are and your race. [5] Androgenetic alopecia can start early, before the age of 30, or later, after the age of 50. It is mainly caused by genetics and hormones called androgens. However, several other things like long-lasting tiny inflammation and oxidative stress have also been suggested. AGA has been connected to heart disease, metabolic syndrome, and prostate cancer because of chronic inflammation. [4] Androgens impact various functions of the human skin, such as the growth and differentiation of sebaceous glands, hair growth, the epidermal barrier, and wound healing, primarily through a complex intracellular signaling pathway. While human hair growth can also be influenced by thyroid hormones and glucocorticoids, androgens play a crucial role as the primary regulators. Depending on the location on the body, androgens can either stimulates, maintain, or inhibit terminal hair growth. In areas where androgens have an effect (such as the beard, axillary, and pubic hair), they can enlarge hair follicles. However, paradoxically, in susceptible men, androgens can suppress hair growth and lead to the miniaturization of hair follicles on the scalp, resulting in shorter hair during the anagen stage and ultimately leading to common baldness. [5]

• Micronutrient deficiency in androgenetic alopecia:

Research has found that people with AGA may have low levels of important nutrients like zinc, copper, selenium, manganese, and magnesium. Zinc, in particular, has been linked to AGA - with lower levels of zinc in the hair correlating with more hair loss. The impact of iron on hair growth is not fully understood, with some studies suggesting a connection between iron deficiency and AGA, while others have found no link. A study in Southwestern Nigeria showed that AGA subjects had slightly lower levels of ferritin compared to the control group, and those with premature AGA had significantly lower ferritin levels compared to those with adult-onset AGA. [4]

2) Alopecia Areata:

Alopecia areata (AA) is a kind of hair loss where there is inflammation around the hair follicles by certain cells called lymphocytes, and sometimes there are also changes in the nails. While AA is believed to be an autoimmune condition, there isn't solid evidence to confirm this. AA can happen to men, women, and kids. It causes hair loss that can be reversed, usually on the scalp but it can also affect other parts of the head like eyelashes and beard. Hair loss can occur in small patches or affect the entire scalp. Some areas may lose hair while others may grow back. In some cases, patients may lose all of their hair. [6] The development of alopecia areata (AA) has been attributed to the dysregulation of various immune-mediated pathways. This occurs in

individuals who are genetically predisposed and exposed to environmental triggers. [7] Four stages have been noted in the histopathology of AA: [7]

1. Acute hair loss
2. Persistent alopecia
3. Partial telogen to anagen conversion
4. Recovery

In all 4 stages of AA, the diagnosis is marked by a "swarm of bees" inflammation around the hair follicles, which does not leave any scars. The inflammation is mainly made up of active T lymphocytes, macrophages, and Langerhans cells. During the early stage of hair loss, there is a failure of matrix cells and melanocytes, leading to the formation of abnormal hair shafts. A noticeable change happens in the hair cycle from the growing phase to the resting phase, leading to more hairs being in the resting and shedding phase. This can be seen when looking at a scalp biopsy. For people with long-term hair loss, the hair follicles stop growing hair. However, for those who fully recover, the hair follicles return to normal with minimal inflammation and no decrease in hair thickness. Eosinophils, a type of white blood cell, can also be found at all stages of alopecia areata. [6]

3) Telogen Effluvium:

Telogen effluvium is a condition in which excessive number of hairs transitioning from the growing (anagen) phase to the resting (telogen) phase of the hair cycle, leading to hair loss around three months later. [8] It is characterized by a temporary, non-scarring, widespread hair loss on the scalp. In 1961,

Kligman was the first to talk about this condition as a problem with hair follicles where a lot of hair falls out. [9] Normally, an individual loses an average of 100 hairs per day, but in telogen effluvium, this number significantly increases, resulting in the loss of 30 to 50 percent of body hair. [8]

Factors that can trigger telogen effluvium include severe illness, injury, infection, surgery, extreme dieting, emotional stress, childbirth, thyroid issues, iron deficiency, anemia, and certain medications. Both hyperthyroidism and hypothyroidism can lead to telogen effluvium, a condition that is typically reversible once the thyroid issues are treated, with the exception of long-term hypothyroidism. There is ongoing debate about whether severe iron deficiency anemia is linked to telogen effluvium. Some drugs known to trigger telogen effluvium include antithyroid medications, hormones, anticonvulsants, anticoagulants, beta blockers, angiotensin-converting enzyme inhibitors, and lithium. In around one third of cases, the underlying cause of telogen effluvium remains unknown. The main approach to managing telogen effluvium is focused on eliminating the root causes of stress or addressing any contributing medical issues. [8]

Treatment for hair loss disorders:

a) Minoxidil:

Minoxidil is a medication used to treat high blood pressure and is an analogue of Ndiallylmelamine N-oxidation. When converted to minoxidil sulphate, it opens ATP-sensitive potassium channels, leading to potassium efflux, hyperpolarization, smooth muscle relaxation, and ultimately vasodilation. Additionally, minoxidil enhances the activity of vascular endothelial growth factor mRNA, activates cytoprotective prostaglandin synthase-1, and increases the expression of hepatocyte growth factor mRNA. The most effective results are typically seen when treating baldness that has been present for less than 5 years. For female and male pattern hair loss, topical 2% and 5% Minoxidil spray is recommended, respectively. Common side effects of minoxidil include increased hair growth (hypertrichosis), dizziness, and postural hypotension. [4]

b) Alpha reductase inhibitors:

Two medications commonly used to treat hair loss are finasteride and dutasteride, which are inhibitors of the enzyme 5-alpha reductase (type II and type I and II inhibitors, respectively). It may take at least 6 months of consistent use before noticeable hair growth occurs. Finasteride is typically taken orally at a daily dose of 1 mg, while dutasteride is taken at a dose of 0.5 mg per day. It is recommended to avoid using this substance during pregnancy as it may lead to the development of ambiguous genitalia in male fetuses of pregnant patients. [4]

c) Low-level laser therapy (LLLT) devices:

Laser therapy can be utilized as a treatment for male androgenetic alopecia (MAGA) for patients who prefer non-pharmacological or non-transplant options. Ablative fractional CO2 laser treatment, when combined with hair growth factors, has shown to stimulate the transition of hair follicles from the resting phase (telogen) to the growth phase (anagen).

This process helps to prolong and enhance hair growth in the anagen phase, while also preventing premature transition to the regression phase (catagen). [4]

B) Scalp Disorders:

While hair and scalp disorders usually don't cause serious physical harm, they can have a big impact on a person's mental health due to how noticeable they are. The scalp in humans is distinct from other skin areas due to its high density of hair follicles and sebum production. Contact with fingers, combs, hats, and styling tools can introduce microorganisms to the scalp, increasing the risk of infections and infestations. The warm and dark environment of the scalp surface provides an ideal breeding ground for superficial fungal infections that contribute to conditions like dandruff, seborrheic dermatitis, and tinea capitis, as well as parasitic infestations like head lice. Scalp alterations can also be observed in inflammatory disorders like psoriasis. [10]

1) Dandruff (Seborrheic Dermatitis):

Dandruff, also known as pityriasis capitis, and seborrheic dermatitis are two related

conditions that fall on opposite ends of the disease severity spectrum. Both are believed to be caused by the presence of a yeast called Malassezia, which was formerly known as Pityrosporum. [10] Dermatological issues that impact the seborrheic regions of the body are known to be a common condition with shared characteristics and responses to comparable treatments. The main differences lie in the affected area and the intensity of the condition. Dandruff specifically affects the scalp, causing itchy, flaking skin without any visible inflammation. Seborrheic dermatitis impacts the scalp, face, retro-auricular area, and upper chest, resulting in flaking, scaling, inflammation, itching, and sometimes pronounced redness. The flakes in seborrheic dermatitis and dandruff are typically white-to-yellowish in color and can be either oily or dry. [11]

Histologically, the progression of seborrheic dermatitis (SD) can be categorized into

two phases. During the acute and sub-acute stages, SD exhibits superficial inflammatory infiltrates around blood vessels and hair follicles, primarily consisting of lymphocytes and histiocytes. This is often accompanied by spongiosis and psoriasiform hyperplasia, with the possibility of parakeratosis surrounding hair follicles ("shoulder parakeratosis"). Additionally, neutrophils may be present in the scale crust at the edges of hair follicles. Several internal and external factors, including sebum production, fungal presence on the skin, personal vulnerability, and their interactions, play a role in the development of the condition. When compared to seborrheic dermatitis (SD), dandruff is a more widespread issue, impacting around 50% of adults globally. It is particularly more common in males than females. Dandruff typically begins during puberty, peaks in severity around the age of 20, and tends to decrease in prevalence among individuals over the age of 50. [11]

2) Psoriasis:

Psoriasis is a long-lasting, systemic inflammatory condition that impacts the skin and other parts

of the body, caused by immune system dysfunction. It impacts approximately 2% of the global population, with half of the cases affecting the scalp. Factors such as limited exposure to UV rays and frequent friction injuries on the scalp may increase the likelihood of psoriasis symptoms appearing. Psoriasis on the scalp could also be a sign of psoriatic arthritis, as a significant percentage of individuals with psoriasis experience joint inflammation. [12]The most prevalent form of psoriasis is plaque psoriasis, accounting for 80-90% of cases, characterized by clearly defined, red plaques with silvery scales. [13]

Treatment of scalp disorders: [11]

1) Antifungal shampoo:
a) Ketoconazole: It can be used as topical treatment.It acts by inhibiting the synthesis of fungal cell wall. It can be formulated as 2% shampoo, cream, gel or foam.
b) Selenium sulphide: The 2.5% shampoo of selenium sulphide is used as topical treatment which act by cytostatic and keratolytic.
2) Anti-inflammatory creams:
Hydrocortisone, Betamethasone dipropionate, Desonide, Fluocinolone comes under category corticosteroid that acts as anti-inflammatory and anti-irritant.
3) Medicated shampoo:
a) Coal tar: 4% shampoo of coal tar act as antifungal, anti- inflammatory, keratolytic, reduces sebum production.

b) Metronidazole: 0.75% in gel form work as anti-inflammatory via inhibition of free radical species.

4) Systemic medication:

Itraconazole used as oral therapy there dose will be 200mg. They act by inhibition of synthesis of fungal cell wall. It also act as anti-inflammatory via inhibition of 5-lipooxygenase metabolites.

C) Hair Structure Disorders:

Hair dysplasias refer to congenital or acquired changes that frequently affect the hair shaft. These abnormalities are typically identified by variations in color, thickness, length, and composition of the hair. The alterations in the hair shaft are commonly caused by modifications in the structure of the hair fibers and cuticles, which can lead to brittle and difficult-to-manage hair. Patients suffering from hair shaft diseases often experience dry and lackluster hair. These diseases can manifest as either localized or generalized disorders. [14]

1) Brittle Hair Syndrome (Trichothiodystrophy):

Trichothiodystrophy (TTD) is a rare genetic disorder characterized by brittle hair

lacking in sulphur. [15] The TTD syndromes are characterized by impaired production of high-sulfur matrix proteins. [16] When examining the hair of individuals with TTD using polarizing microscopy, a distinct pattern of alternating light and dark bands known as "tiger tail banding" can be observed. TTD is caused by mutations in various DNA repair genes such as XPB, XPD, TTDA, and TTDN1, a gene with an unidentified function. [15]

Treatment:

Patients with Trichothiodystrophy (TTD) typically have intricate healthcare requirements and can gain from a comprehensive approach involving various medical disciplines. There are currently no established protocols for the medical treatment of TTD, with management primarily being symptom-based. Individuals who are susceptible to ultraviolet rays should be shielded from sunlight and other sources of ultraviolet radiation to avoid serious skin burns. Patients are advised to refrain from staying outdoors for extended periods without proper protection. [17]

2) Trichorrhexis Nodosa:

Trichorrhexis nodosa (TN) is a prevalent abnormality of the hair shaft that occurs in reaction to either chemical or physical harm. This condition can be triggered in healthy hair through repeated and intense trauma. It can be either inherited or acquired. Acquired TN is more common and typically develops in response to excessive physical or chemical stress. Overly vigorous combing and frequent use of hair dryers or straighteners can cause damage to the protective outer layer of the hair (cuticle) and lead to the splitting of inner hair fibers, forming nodes. [18]

Treatment:

The management of Trichorrhexis nodosa is tailored based on its specific type. For acquired cases, minimizing or completely avoiding physical damage can lead to improvement. If there are any underlying medical conditions associated with Trichorrhexis nodosa, they are appropriately addressed through treatment. To avoid hair breakage, it is advisable to maintain proper hydration and conditioning. It is suggested that individuals experiencing this issue should practice gentle hair care techniques and refrain from harsh treatment. In instances where the condition is hereditary, treatment options may be limited due to a genetic defect. At times, there can be a positive change and restoration in hair growth as individual age, leading to normal hair growth. [19]

D) Infectious Hair Diseases:

1) Head Lice (Pediculosis):

Pediculosis refers to the presence of external parasites on the human scalp. The

specific type of lice responsible for this condition is Pediculus humanus var. capitis De Geer, which belongs to the Pediculidae family of Anoplura insects and feeds on human blood. The primary indication of head lice infestation is an itchy scalp, while the presence of live eggs confirms the diagnosis. Females are more commonly affected by lice infestations, with rates 2 to 4 times higher than males, particularly in rural and developing regions due to longer hair. While pediculosis is not a significant health concern as it does not spread diseases, it can lead to social stigma, isolation, parental stress, peer pressure, excessive school absences, and challenges for school management. [20]

Mode of transmission:

The primary mode of lice transmission among individuals who are susceptible is through close

personal contact and sharing of headgear. Head-to-head contact is the most frequent method of lice transmission. Head lice do not have the ability to fly due to their lack of wings, and they also do not have strong legs for jumping. Instead, they transfer from one host to another by using the claws on their legs. [20]

Treatment: (20)

a) Permethrin(1%): It comes under group synthetic pyrethroid. It disrupts the sodium channel current leading to delayed depolarization. Method of use is by topical application on clean and dry hair for 10 minute.

b) Topical ivermectin(1%): Comes under avermectin which inhibit glutamate gated chloride channel kills head lice by asphyxiation.

2) Ringworm of the Scalp (Tinea Capitis):

Tinea capitis is a prevalent fungal infection that commonly affects the scalp hair of children before adolescence. It is caused by dermatophytes that feed on keratin, which is the main component of hair. The responsible dermatophytes come from two genera: Trichophyton and Microsporum. During the first half of the 20th century, Microsporum audouinii was the main culprit behind tinea capitis in the United States.

However, Trichophyton tonsurans is now accountable for up to 95% of cases in the country. [21]

Various factors can increase the vulnerability of certain adults to TC infections.

Individuals at the opposite ends of the age spectrum, such as young children and older adults, are more prone to TC infections. The start of puberty offers a level of protection against TC due to an increase in sweat, sebum, and hair thickness. Elderly women who have gone through menopause may face a higher likelihood of developing dermatophytosis. This is attributed to a reduction in sebum production caused by lower estrogen levels, leading to decreased production of fatty acids and a loss of scalp acidity. [22]

Treatment:

a) Griseofulvin:

Griseofulvin has been utilized as a primary treatment for tinea capitis since the late 1960s and is widely recognized as the most effective therapy. This medication is included in the essential medicines list by the World Health Organization (WHO). In the United States, it is approved by the FDA for treating tinea capitis in children aged 2 years and older, with a recommended daily dosage of 10 mg/kg. Griseofulvin is a fungus-inhibiting substance created by different strains of the Penicillium mold. It works by attaching to microtubules and preventing the mitotic spindle from contracting. When taken orally, Griseofulvin is not well absorbed by the body. Micronized formulations such as Grifulvin V and ultramicronized formulations like Gris-PEG are utilized to improve absorption rates. With micronized formulations, the highest level of medication in the bloodstream is typically reached around 4 hours after taking an oral dose. [21]

b) Terbinafine:

Terbinafine, commonly referred to as Lamisil®, is a type of allylamine derivative

that possesses fungicidal properties. It acts as a non-competitive inhibitor of squalene epoxidase, which is a crucial enzyme involved in the production of ergosterol, a vital component of fungal cell membranes. Following oral administration, approximately 70-80% of the medication is quickly absorbed and reaches its highest concentration in the bloodstream within 2 hours. Food intake does not impact the absorption of this substance. [21]

CONCLUSION

In conclusion, hair disorders encompass a variety of issues, including hair loss, scalp conditions, structural irregularities, and infections, each with distinct causes and symptoms. Factors such as genetics, hormonal changes, autoimmune reactions, and environmental variables play a role in the onset and development of these issues. Prompt diagnosis and tailored treatment are crucial for effectively managing these conditions, as early interventions can alleviate symptoms, encourage hair regrowth, and improve quality of life. Due to the progress in treatment choices like topical medications, laser therapy, and antifungal or anti-inflammatory treatments, people dealing with hair-related issues now have a better opportunity to tackle their problems and improve the health of their hair.

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