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Vertigo Associated with Topical Minoxidil Use in a Patient with Scalp Barrier Disruption: A Case Report

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Abstract:

Minoxidil is an FDA-approved topical medication of over-the-counter solutions used to treat androgenetic alopecia and other types of alopecia. It is a relatively safe topical medication used in dermatology clinics to promote hair growth. Minoxidil (2,4-diamino-6 piperidinopyrimidine-3-oxide), the active ingredient available as a solution or gel, is associated with numerous side effects, particularly when percutaneous absorption is increased. A 45-year-old man visited the emergency department with sudden vertigo, which was caused by excessive use of minoxidil solution and scalp irritation, and the symptoms resolved after he washed his hair and stopped using minoxidil. Systemic absorption is likely enhanced when the scalp skin barrier is disrupted, potentiating vasodilatory effects and subsequent vestibular symptoms. This case report highlights vertigo as an underrecognized systemic side effect of topical minoxidil, especially in the setting of impaired skin integrity and excessive use. Clinicians should be aware of this potential side effect and counsel patients on proper application practices..

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Introduction

Minoxidil (2,4-diamino-6-piperidinopyrimidine-3-oxide) is a potent oral antihypertensive agent that exerts its effects via minoxidil sulfate, its active sulfate metabolite, which binds to and opens ATP-sensitive potassium channels in arterial vascular smooth muscle cells [1]. It is an FDA-approved topical medication (solution and gel) used to treat many types of hair loss, such as androgenetic alopecia and other types of hair fall [2]. Due to its ability to enhance hair growth and decrease hair fall, this active component is used in dermatology clinics; while generally well tolerated, topical minoxidil can be associated with both common and rare adverse effects [3-5]. A case report of a 45-year-old man who experienced vertigo after applying excessive topical minoxidil solution to the scalp with abrasions underscores the significance of identifying systemic side effects linked to compromised skin barrier integrity.

Case Presentation

A 45-year-old male presented to the emergency department with a sudden onset of vertigo that started in the early morning hours. The night before, he had applied an excessive amount of 5% topical minoxidil solution to his scalp, approximately 4 mL (equivalent to 8 sprays, compared to his usual 2 sprays), twice at night, instead of his usual 1 mL once at night. He had been using topical minoxidil regularly for two years following scalp hair transplantation. Over the preceding weeks, he developed scalp irritation and superficial abrasions due to scratching, along with mild folliculitis. He

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also reported occasional daytime headaches following minoxidil application.

Upon presentation, the patient experienced severe vertigo that prevented him from sitting or standing unassisted. He was evaluated by emergency medicine, neurology, internal medicine, and otolaryngology consultations. Blood tests, brain magnetic resonance imaging (MRI), and otoscopic examination were unremarkable. No central or peripheral vestibular pathology was identified. Serial blood pressure measurements were within normal limits. The patient reported no use of other medications or substances, no recent illnesses, and no history of head trauma or prior vestibular disorders.

Dermatological examination showed scalp abrasions and mild folliculitis, consistent with chronic topical minoxidil therapy. These findings suggest a compromised scalp skin barrier, which enhances percutaneous absorption of topical minoxidil, which leads to the patient's symptoms through potential systemic vasodilatory effects. The temporal relationship between excessive minoxidil application and symptom onset, combined with the presence of scalp abrasions and folliculitis, indicates a compromised skin barrier, suggesting that systemic absorption of minoxidil was the likely cause. The patient was advised to discontinue minoxidil and treat the folliculitis. Symptoms improved within 24 hours without any further treatment.

Discussion

Background and Mechanism of Action Minoxidil was originally developed as an oral antihypertensive; its hypertrichosis side effect later led to the development of topical formulations for hair loss [6]. Today, topical minoxidil is widely used for androgenetic alopecia, telogen effluvium, and other hair fall disorders. The mode of action of topical minoxidil for hypertrichosis and enhanced hair growth is not fully understood, although it is believed to prolong the anagen phase in hair follicles [2, 6]. There is also evidence that alterations in enzymatic and hormonal pathways occur [7]. It is generally safe, with most adverse effects limited to local reactions such as contact dermatitis [7]. However, systemic side effects, including hypotension, syncope, paresthesia, and chorioretinopathy, have been reported, particularly with excessive application or increased percutaneous absorption [8-12].

Factors Influencing Systemic Absorption Systemically available amounts of approximately 2–5 mg of topically applied minoxidil may be compared to the average oral antihypertensive dose of 10–40 mg/day [13]. This could produce systemic manifestations such as dizziness, hypotension, presyncope, and, in rare cases, syncope [3]. Reports from US Poison Centers from 1985 to 1991 concluded that all reported topical exposures resulted in 'minor' to 'no effects' [14]. In our case report, scalp abrasions and folliculitis disrupted the stratum corneum, enhancing transdermal absorption. The patient also applied an excessive volume (approximately 4 mL) twice the night before the onset of symptoms, increasing systemic exposure even further.

Temporal Relationship and Causality Assessment The temporal sequence in this case strongly supports a pharmacologically mediated effect. Symptoms developed within hours of excessive application and resolved after scalp washing and discontinuation of the drug. The Naranjo Adverse Drug Reaction Probability Scale yielded a score of 8 **(Table 1)**, indicating a probable adverse drug reaction. The score reflects conclusive previous reports, temporal association, improvement upon withdrawal, absence of alternative causes, and objective evidence supporting the reaction.

Differential Diagnosis Vertigo is a specific subtype of dizziness characterized by an illusory sensation of motion, mostly described as a spinning or rotational feeling, either of the patient or the surrounding environment. This symptom is divided into peripheral and central causes. Peripheral causes are often triggered by movement, while central causes indicate problems in the nervous system. The differential diagnosis of acute vertigo includes peripheral causes such as benign paroxysmal positional vertigo (BPPV), vestibular neuritis, and labyrinthitis, as well as central causes, including cerebrovascular events. In this case, normal neurological examination, unremarkable brain MRI, and absence of hearing loss or viral prodrome effectively excluded structural or primary vestibular disorders. Orthostatic hypotension was considered, but serial blood pressure measurements remained

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normal; however, transient nocturnal hypotension could not be entirely excluded.

Clinical Implications This case highlights that topical minoxidil, while generally safe, can cause systemic vestibular symptoms when absorption is enhanced. Clinicians should advise patients to limit their application and to stop using the product if they experience scalp irritation or disruption. In patients presenting with unexplained vertigo, a history of topical minoxidil use, especially in the setting of compromised skin integrity, should be considered.

Limitations and Future Directions The mechanisms underlying systemic absorption of topical minoxidil and the precise plasma concentration thresholds for vertigo remain incompletely understood. Further studies are needed to better characterize the incidence and risk factors for systemic adverse effects associated with topical minoxidil use.

Conclusion

Topical minoxidil is generally considered safe, but it may occasionally cause undesirable systemic side effects. We draw attention to this side effect as a possible and unrecognized systemic side effect, especially under specific circumstances such as excessive use of minoxidil solution or with compromised skin barriers. There is a clear association between the use of the treatment and the onset of vertigo, in addition to its disappearance after stopping medication and washing the scalp. Given the theory that this treatment is the cause, doctors should focus on this symptom as a systemic side effect when using this topical treatment, as well as on the necessary measures to stop this symptom.

Learning Points

Topical minoxidil may lead to systemic symptoms despite its topical application.

Excessive use of minoxidil, combined with compromised scalp barriers such as irritation or abrasions, may lead to increased systemic absorption, resulting in a rare side effect of vertigo.

The clear temporal relationship between treatment use and symptom onset, as well as symptom resolution upon treatment discontinuation, may be the primary cause.

Physicians should consider this in any patient presenting with unexplained vertigo associated with excessive use of topical minoxidil or with factors that enhance its transdermal absorption and should determine how to manage such cases.

Highlights

Vertigo is a rare adverse effect of topical minoxidil.

Role of scalp barrier disruption in increasing systemic absorption.

Importance of temporal relationships in identifying drug-induced symptoms.

Symptom resolution following drug discontinuation and scalp washing.

Need for clinician awareness of systemic effects of topical therapies.

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Table 1: Naranjo Adverse Drug Reaction Probability Scale

Question	Yes	No	Do Not Know	Score
1. Are there previous conclusive reports on this reaction?	✔			+1
2. Did the adverse event appear after the suspected drug was administered?	✔			+2
3. Did the adverse reaction improve when the drug was discontinued (dechallenge)?				
4. Did the adverse reaction reappear upon re-administration (rechallenge)?			✔	0
5. Are there alternative causes that could have caused the reaction?		✔		+2
6. Did the reaction reappear when a placebo was given?			✔	0
7. Was the drug detected in blood (toxic concentrations)?			✔	0
8. Was the reaction more severe with increased dose or less severe with decreased dose?	✔			+1
9. Did the patient have a similar reaction to the same or similar drugs previously?			✔	0
10. Was the adverse event confirmed by objective evidence?	✔			+1