Case Report

Cosmetic catastrophe: A case report of delayed anaphylactic shock likely following hair dye exposure

Kiran Kuraning[1], K. M. Ganesh[2], Pooja Prathapan Sarada[2], Garud Suresh Chandan[3], Padmakumar Arayamparambil Vijayan[3]

From [1]DrNB Superspeciality Trainee, [2]Consultant, [3]Director and Senior Consultant, Department of Critical Care Medicine, Fortis Hospitals, Bengaluru, Karnataka, India.

ABSTRACT

Hair dye-related allergic reactions are increasingly common, mainly due to para-phenylenediamine (PPD) in permanent hair dyes. Systemic hypersensitivity reactions such as anaphylaxis are rare and may present atypically. We report a 61-year-old man with hypertension and ischemic heart disease who presented with recurrent syncope and hypotension. During intensive care stay, he developed progressive facial, periorbital swelling, and worsening hypotension. History revealed recent hair dye application followed by scalp and facial pruritus, suggesting possible hair dye-induced anaphylaxis. The patient improved with adrenaline, antihistamines, corticosteroids, and fluids. This case highlights the importance of detailed exposure history and early recognition of anaphylaxis in unexplained syncope or shock.

Key words: Anaphylaxis, Hair dye, Hypersensitivity, Para-phenylenediamine, Syncope

Adverse reactions to cosmetic hair dyes are being reported with increasing frequency due to the widespread use of these products for personal grooming. Permanent hair dyes commonly contain aromatic amines such as para-phenylenediamine (PPD), known to cause allergic contact dermatitis through sensitization. In most individuals, hypersensitivity to hair dye manifests as localized allergic contact dermatitis involving the scalp, forehead, eyelids, or neck. These reactions are typically mediated by delayed type IV hypersensitivity and present with pruritus, erythema, and swelling within a few days after exposure [1,2]. Although cutaneous manifestations are most common, systemic allergic reactions related to hair dye exposure are uncommon but potentially severe. Rarely, patients may develop generalized urticaria, angioedema, or even anaphylaxis. Clinical presentations can sometimes be atypical, and cardiovascular manifestations such as syncope may occur due to transient hypotension and reduced cerebral perfusion during systemic hypersensitivity reactions [3,4].

In this report, we describe an unusual case of delayed systemic hypersensitivity possibly following exposure to an artificial hair dye, initially presenting with recurrent syncope and subsequently progressing to anaphylactic shock. This case highlights the importance of considering cosmetic allergens in the differential diagnosis of unexplained syncope and shock.

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CASE REPORT

A 61-year-old man with premorbid conditions of hypertension (since 20 years) and ischemic heart disease (since 6 years), previously treated with coronary artery bypass grafting, and with a World Health Organization performance status of 1, presented to the emergency room (ER) with nausea followed by an episode of syncope associated with unresponsiveness lasting approximately 3 min. This was followed by another similar episode lasting about 2 min. There were no witnessed seizures, abnormal limb movements, incontinence, or post-ictal confusion. Family members denied any other associated symptoms.

On arrival to the ER, he had oxygen saturation of 99% on room air, heart rate of 77 beats/min, blood pressure of 80/60 mmHg, temperature of 98.4°F, and random blood glucose of 182 mg/dL. He was conscious, oriented, and neurologically intact without focal deficits. The electrocardiogram showed sinus rhythm, and arterial blood gas analysis was within normal limits. Physical examination revealed mild swelling over the right periorbital region (Fig. 1).

Given the history of recurrent syncope, intracranial pathology was considered. Magnetic resonance imaging

Correspondence to: Kiran Kuraning, DrNB Superspeciality Trainee, Department of Critical Care Medicine, Fortis Hospitals, Bengaluru, Karnataka, India. E-mail: kirankuraning@gmail.com

Figure 1: Periorbital and facial edema in our patient secondary to dye anaphylaxis

of the brain and electroencephalogram were performed, both of which were unremarkable. In view of hypotension, the patient was admitted to the medical intensive care unit (MICU) for management and further evaluation.

In the MICU, he was managed with intravenous fluid resuscitation infusion guided by point-of-care ultrasound, along with clinical parameters. He was worked up for the cause of shock and syncope with cultures, tropical fever workup, and cardiac enzymes, which were negative. Meanwhile, the swelling around the right eye significantly progressed to involve bilateral periorbital regions and subsequently the entire face, with worsening hypotension in spite of fluid resuscitation. No other regular medications were contributing to shock and angioedema.

A detailed history obtained from the patient revealed that he had applied an artificial hair dye 2 days before presentation. He reported experiencing mild pruritus over the scalp, neck, and face following its application, for which he had self-medicated with cetirizine for 2 days. He also reported prolonged outdoor walking for 2–3 h daily over the preceding 2 days with significant sun exposure.

Based on the temporal association, progressive facial swelling, and evolving hemodynamic instability, as per World Allergy Organization 2020 criteria [5], a diagnosis of anaphylaxis, possibly secondary to hair dye exposure, was considered. The clinical picture suggested a combination of early and delayed hypersensitivity reactions.

The patient was treated with intramuscular adrenaline (0.5 mg), intravenous hydrocortisone (100 mg stat followed by 50 mg every 6 h), intravenous pheniramine maleate (22.75 mg), oral antihistamines, and aggressive intravenous fluid resuscitation. Due to persistent hypotension, an intravenous adrenaline infusion (5 mg adrenaline + 45 mL normal saline, titrated as per blood pressure) was initiated and continued for 16 h.

Over the subsequent 24–36 h, the patient demonstrated gradual hemodynamic stabilization and a significant reduction in facial swelling. Laboratory investigations did not reveal evidence of alternative causes of shock (Table 1). Elevated C-reactive protein and leukocytosis were possibly related to anaphylaxis. A review of the literature revealed rare reports of delayed anaphylactic reactions following exposure to hair dye.

The patient continued to improve clinically and was transferred to the general ward after 48 h of MICU stay. He was subsequently discharged home with a 5-day course of oral medications, including famotidine 20 mg twice daily and levocetirizine 5 mg once daily at night. He was educated about possible similar events in the future and a dermatologist referral.

DISCUSSION

Allergic reactions to hair dye products are increasingly encountered in clinical practice due to the widespread use of cosmetic hair coloring agents. PPD, an aromatic amine commonly present in permanent hair dyes, is the major sensitizing compound responsible for most reported allergic reactions. After penetrating the skin, PPD undergoes oxidation and forms reactive metabolites capable of binding to proteins and triggering immune responses. While most reactions remain confined to the skin, systemic hypersensitivity reactions have occasionally been described [1,2]. Most of the hair dye-related reactions occur through a delayed type IV hypersensitivity mechanism, typically presenting as allergic contact dermatitis involving the scalp, forehead, eyelids, or neck. Symptoms usually appear within 24–72 h and include pruritus, erythema, and localized swelling. The periorbital region is particularly prone to marked edema because of its thin skin and loose connective tissue, allowing rapid diffusion of allergens and accumulation of inflammatory fluid [6].

Although uncommon, systemic manifestations such as urticaria, angioedema, bronchospasm, and anaphylaxis may occur. These reactions are thought to involve immunoglobulin E-mediated type I hypersensitivity, and in some patients, a combination of immediate and delayed immune responses may produce atypical or delayed systemic features.

Syncope is an important but often overlooked manifestation of systemic hypersensitivity reactions. During anaphylaxis, widespread vasodilation and increased vascular permeability lead to reduced venous return and transient cerebral hypoperfusion, which may result in loss of consciousness. When syncope precedes obvious allergic manifestations, the presentation can mimic neurological or cardiac causes, making diagnosis challenging.

In the present case, the patient initially presented with recurrent syncope and no clear allergic features, prompting evaluation for neurological causes. Then evaluated for shock with the possibility of sepsis, tropical illness, or cardiac event. However, the subsequent development of progressive periorbital swelling and hypotension, together with the history of recent hair dye exposure, suggested an evolving systemic hypersensitivity reaction. The delayed

Table 1: Detailed workup in our patient

Investigations	Results	Investigations	Results
Hemoglobin	15.4 g/dL	S.Sodium	130 mmol/L
WBC count	13.1 thousand/µL	S.Potassium	4.2 mmol/L
Platelets	259 thousand/µL	TB/DB	1.35/0.73 mg/dL
S.Creatinine	1.06 mg/dL	ALT/AST	13/15 U/L
Troponin I (0 h→6 h)	12→10.6 pg/mL	CRP	80.9 mg/L
Urine routine analysis	Normal	Dengue panel Leptospira IgM	Negative Negative
2D-ECHO	Normal LVEF-55%, PASP-28 mmHg, TAPSE-19 mm, no RWMA		
MRI brain	Age-related periventricular small vessel ischemic changes		
EEG	Normal study		

WBC: White blood cell, TB/DB: Total bilirubin/direct bilirubin, ALT/AST: Alanine aminotransferase/aspartate aminotransferase, CRP: C-reactive protein, 2D-ECHO: 2-Dimensional echocardiogram, RWMA: Regional wall motion abnormality, EEG: Electroencephalogram, MRI: Magnetic resonance imaging, IgM: Immunoglobulin M, LVEF: Left ventricular ejection fraction, PASP: Pulmonary artery systolic pressure, TAPSE: Tricuspid annular plane systolic excursion

progression of symptoms following initial pruritus raises the possibility of a delayed or biphasic anaphylactic response [7]. Ultraviolet exposure, as in the present case, may aggravate hair dye-related hypersensitivity by promoting photochemical modification of allergens such as PPD, which can enhance antigenicity and intensify immune responses in sensitized individuals [6].

Cross-reactivity between PPD and structurally related aromatic amines, such as toluene-2,5-diamine, is another important consideration. Individuals sensitized to PPD may therefore react to products labeled as "PPD-free" if they contain related compounds. Patient education regarding the avoidance of such products is therefore essential.

Management follows standard anaphylaxis protocols, with prompt intramuscular adrenaline being the most critical intervention. Adjunctive therapy includes antihistamines, corticosteroids, and intravenous fluid resuscitation. Patients with persistent hypotension may require vasopressor support and close monitoring in an intensive care setting. Early recognition and timely treatment significantly improve outcomes [5]. Patients with PPD allergy should be advised to avoid permanent oxidative hair dyes and consider safer alternatives such as non-ammonia, PPD-free, or vegetable-based hair dyes after appropriate patch testing [8].

This case emphasizes the importance of considering cosmetic products such as hair dyes as potential triggers in patients presenting with unexplained syncope, facial swelling, or shock. Careful history taking and early recognition of systemic hypersensitivity are essential for timely diagnosis and appropriate management.

CONCLUSION

This case illustrates an uncommon presentation of suspected hair dye-induced systemic hypersensitivity progressing to anaphylactic shock. Although allergic reactions to hair dye are typically limited to localized contact dermatitis, clinicians should remain aware that systemic manifestations can occur and may initially present with non-specific features such as syncope. In such situations, the absence of early cutaneous manifestations may lead to diagnostic uncertainty and delay appropriate treatment. A detailed history regarding recent exposure to cosmetic or chemical agents can provide an important diagnostic clue. Early recognition of evolving anaphylaxis and prompt administration of adrenaline remain the cornerstone of management and are critical in preventing serious complications. This report highlights the need to consider cosmetic products as potential triggers in patients presenting with unexplained syncope, facial swelling, or shock.

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