

Permanent Press Allergy in an Active Duty U.S. Army Soldier

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ABSTRACT Ethylene urea/melamine formaldehyde resin (permanent press) is a common fabric finishing agent added to Army Combat Uniforms for a wrinkle-free appearance and to strengthen the fabric. We describe the case of an active duty U.S. Army soldier with a diffuse eczematous dermatitis in whom patch testing was used to identify an allergy to permanent press, a ubiquitous fabric finishing agent in the Army combat uniform. To our knowledge, this is the first case report of a soldier with an allergic contact dermatitis to ethylene urea/melamine formaldehyde resin. This case highlights the importance of considering the diagnosis of allergic contact dermatitis in patients with a recurrent eczematous dermatitis that does not respond appropriately to therapy and the unique occupational impact of diagnosing an Army soldier with permanent press allergy.

INTRODUCTION

We report a case of diffuse eczematous dermatitis in an active duty U.S. Army soldier who was patch test–positive to a fabric finishing agent used in the manufacturing of the Army combat uniform (ACU). Natural fibers, such as cotton, silk, or linen, rarely cause an allergic contact dermatitis. Since 1926, formaldehyde textile resins (FTRs) have been added to fabrics for strength, prevention of shrinking, and wrinkle resistance (permanent press). Fabrics with a combination of synthetic and natural fibers (blended fabrics) are more likely to contain FTRs than natural fabrics. Today, FTRs are commonly used in clothing and have been reported as a significant cause of under-diagnosed dermatitis.^{1–4} The typical presentation is of a subacute or chronic dermatitis worse in areas of friction with sparing of the axillary vaults, but several atypical presentations have also been reported, to include erythema multiforme-like, nummular eczema-like, purpuric dermatitis, lichenification, or erythroderma.^{4,5}

There are many FTRs a manufacturer can use to try impart permanent press features to textiles. For a complete review of the history of FTR use, diagnosis, and management, one is referred to an excellent review article by Reich,⁶ and for a review of early use of formaldehyde resins, one is referred to a review by Storrs.⁷ Ethylene urea melamine formaldehyde (EUMF) was introduced in the 1930s and is classified as an “older” resin given its ability to release high amounts of formaldehyde.⁸ In the 1980s, “new resins” were developed that maintained permanent press features but release smaller amounts of formaldehyde.

In 2005, the U.S. Army began replacing their woodland and 3-color desert-pattern battle dress uniform with the ACU. This new ACU was touted as designed by soldiers for soldiers, with functionality in mind. Fifty-fifty cotton/nylon wrinkle-free fabric, pockets for pen/pencil, elbow and knee pads for added protection, and drawstrings at the ankles and waist for improved comfort and fit were among the improvements in the ACU. Upon a literature review and to the best of our knowledge, this is the first case report of an FTR allergy to the ACU.

OBSERVATION

In December 2009, an active duty U.S. Army soldier presented with a recurrent, pruritic, generalized patchy eczematous dermatitis—worse on the arms, thighs, and distal legs. In areas of friction, he noted tenderness associated with the dermatitis that adversely affected his job performance. The symptoms first developed in April 2008 while deployed to Iraq and had been treated with oral prednisone every 2 months for control. An otherwise healthy individual with no history of asthma, allergic rhinitis, or atopy, this soldier has been in the Army for 2 years as an infantryman.

Patch testing was undertaken with the North American Standard tray and with material from the inner part of his combat boot. On day 2, he had a (+) positive reaction to EUMF mix in 5% petrolatum. On day 7, he had a (+++) positive reaction to EUMF mix and a (+) positive reaction to 4-tert-butyl-pheno formaldehyde resin. Both these reactions were interpreted as relevant to his dermatitis. EUMF resin is the permanent press finishing agent in his uniform and is present in many other blended fabrics. The 4-tert-butyl-pheno formaldehyde resin is used in adhesives for shoes, leather products, and rubber articles—both of which are in his combat boots. The patient was treated topically with fluocinonide ointment, instructed to avoid items containing the allergens, and placed on a profile to wear physical training gear and sneakers rather than ACUs and combat boots. Consequently, he was referred to occupational health for evaluation and advice regarding the potential for career impact.

DISCUSSION

Allergic contact dermatitis to clothing is most commonly caused by chemicals utilized in the manufacturing of the garment, rather than the actual fibers of the cloth, whether natural (cotton, silk, linen) or synthetic (rayon or nylon). Our patient had a pruritic patchy chronic eczematous dermatitis for several months, worsened in areas of high friction under his uniform. On patch testing, he reacted strongly to EUMF mix and 4-tert-butyl-pheno formaldehyde resin.

The 2 most common causes of allergic contact dermatitis from clothing are a textile finishing allergen, such as permanent

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press, or a textile dye allergen, such as disperse azo and anthraquinone dyes. EUMF resin is one of a group of resins, derived from urea and melamine formaldehyde polycondensation, which is polymerized within cloth fibers to achieve wrinkle-free and shrink-resistant clothing, fabrics, and bedding. The dermatitis produced by an allergy to this agent is referred to as permanent press dermatitis and can be from either the formaldehyde released by the resin or the resin itself. Permanent press is widely used in the United States in civilian clothing and in the U.S. ACU. A reaction to permanent press occurs in about 7.2% of individuals, according to the testing by the North American Contact Dermatitis group.⁹

The clinical picture of clothing-induced dermatitis is usually a generalized pruritic patchy eczematous dermatitis involving the clothed areas—typically sparing the head, hands, and those areas covered by a second layer. Accentuation in areas where clothing is the tightest may be noticed, such as the neck, axillae, and thighs. Patients may relate their pruritus and rash to clothing, but often incorrectly attribute it to detergents, fabric softeners, or dry cleaning chemicals. Erythema multiforme like, nummular eczema like, erythroderma, and a purpuric dermatitis are some of the atypical presentations reported in the literature.^{4,5} Nummular dermatitis, atopic eczema, scabies, and neurodermatitis often appear similar, potentially leading to a delay in diagnosis and subsequent appropriate treatment.

Diagnosis of a FTR allergy relies on a combination of clinical awareness and patch testing but still may be difficult. Even with a high index of clinical suspicion, patch testing for the allergen is complicated as there is no “gold standard” resin recommended for testing. Patch testing with clothing has been suggested for diagnosis, but a high false negative rate puts the value of this test in question.^{10,11} EUMF has been recommended as a screening agent for FTR allergic contact dermatitis^{1,9} and proved to be the diagnostic allergen in this case report. However, its utility as the most appropriate screening agent for FTR allergic contact dermatitis has not been confirmed¹² and is, therefore, still under debate. For a list of the current commercial textile resin allergens available for testing, refer the review by Reich.⁶ EUMF resin and formaldehyde are included in the North American Standard tray and are thought to be the best screening agents for a resin allergy, as a majority of patients are sensitive to these allergens. As in this patient, when a specific item of clothing is suspected, it should also be patch tested, although a negative test does not exclude the diagnosis. The recommended procedure to patch test cloth is to soak the suspected item in water or saline for 15 minutes, before applying in a Finn Chamber, and leaving in place for 72 to 96 hours.⁹

Once a textile allergy is identified, the primary recommendation is avoidance of the allergen. Our patient was instructed to avoid garments labeled as “permanent press,” “easy care,” or “wrinkle free” as well as rayon blends, corduroy, blended

fabrics (cotton–polyester) and shrink-proof wool. He should wear loose-fitting garments composed of 100% Silk, linen, wool, denim, nylon, polyester, or mercerized cotton. If he must wear an item of clothing that is not recommended, it is advised that he wear silk or nylon underneath. Consideration also needs to be given to avoidance of FTRs in nonwoven textiles, such as the N95 mask, surgical drapes, and patient gowns, all commonly used in the hospital setting.³

This is a case report of an active duty soldier who is allergic to his uniform because of an FTR allergy to EUMF or, in simpler terms, a permanent press allergy. How many soldiers will be affected by this currently unavoidable dermatitis remains unknown, and the career implications for those not able to wear the ACU are still being decided. Rather than placing the soldier on a permanent profile to wear physical training gear, the other possible solution is to have an alternative combat uniform that does not contain permanent press. Although wearing silk or nylon underneath suspected clothing is listed as a recommendation, in the setting of sweat, this will not stop leaching of formaldehyde and EUMF resin to the skin. Though providing a uniform lacking permanent press may not be cost effective for just 1 soldier, it may be warranted when one considers the approximately 35,000 people in the army who may also be allergic, especially, if one reckons the offset in associated costs of missed duty days, doctor's visits, and overall discomfort of the affected soldiers.

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