

Allergic Contact Dermatitis in Operation Iraqi Freedom: Use of the T.R.U.E. Test in the Combat Environment

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Background: Refractory dermatitis can frequently cause loss of personnel and poses an economic drain on the military due to the evacuation of civilians and soldiers out of theater.

Objective: Proof-of-concept retrospective analysis to review the utility of the T.R.U.E. Test in the combat environment.

Methods: Thirty T.R.U.E. Tests were performed by the dermatology clinic in Baghdad, Iraq, between January 15, 2008, and July 15, 2008. Thirty active-duty and civilian contractors referred to the dermatology clinic for dermatitis were tested and four others were clinically rechallenged for suspected bacitracin contact allergy.

Results: Of the 30 patients tested, 14 (46.7%) had a positive test reaction to at least one antigen. In these positive tests, nickel, neomycin, and thimerosal each comprised 17% followed by neomycin, thimerosal, budesonide, epoxy resin, potassium dichromate, p-phenylenediamine, formaldehyde, quaternium-15, fragrance, and balsam of Peru. All four clinical rechallenges for bacitracin allergy were also positive.

Conclusions: The use of the T.R.U.E. Test in the combat desert environment is an efficient, easy, and clinically relevant method of testing for allergic contact dermatitis. Continued study of the prevalence of allergic contact dermatitis at Ibn Sina Hospital, Baghdad, Iraq, is recommended.

BEGINNING in July 2004, the US Army opened a forward deployed dermatology clinic at Ibn Sina Hospital, Baghdad, Iraq. This clinic holds responsibility for all in-theater dermatology consults for both active-duty military and civilian contractors and serves as a clearing house for all dermatology referrals. As previously reported by Schissel and Wilde, dermatologic conditions account for 15 to 75% of all outpatient visits in a combat environment.¹ In particular, allergic contact dermatitis can cause significant interference with the ability of a service member or civilian contractor to adequately perform his or her duties in an environment that has limited dermatologic resources.

Contact dermatitis has accounted for 1% (as seen during our study) to 9.6%² of skin conditions in US Army personnel treated during combat operations. More commonly encountered is the generic “dermatitis” or

“eczema,” which could potentially represent undiagnosed allergic contact dermatitis. A properly applied and accurately interpreted patch test is currently the only scientific diagnostic method for confirming allergic contact dermatitis.³ Patch testing could enhance the diagnostic accuracy of the deployed medical care provider. Without accurate diagnoses, patients may continue to be exposed daily to an allergen, resulting in treatment failure and personnel loss.

This study is a proof-of-concept retrospective analysis to review the usefulness of the Thin-Layer Rapid Use Epicutaneous Test (T.R.U.E. Test) (Mekos Laboratories A/S, Hillerød, Denmark) in the combat environment. Although several other articles have discussed allergic contact dermatitis among military personnel,^{2,4,5} to the authors’ knowledge, this is the first article to address patch testing for diagnosing allergic contact dermatitis in a combat environment.

Methods

In January 2008, the forward deployed dermatologist (J.S.H.) at Ibn Sina Hospital, Baghdad, Iraq, was alerted to the presence of 30 unused T.R.U.E. Tests already in theater. He was able to obtain these 30 patch tests and developed this proof-of-concept study. Between January 15, 2008, and July 15, 2008, patients included in the study

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were initially referred to the dermatologist by their primary care managers owing to persistent dermatitis despite numerous efforts to treat. After a thorough history and physical examination by the dermatologist, only those patients with a high likelihood of allergic contact dermatitis based on clinical experience were patch-tested. Patients were enrolled in the study until all 30 T.R.U.E. Tests were used.

The T.R.U.E. Test was used because of its ease of application and ease of storage. T.R.U.E. Test panels 1 and 2 were applied to the patients' backs. The panel borders were outlined in gentian violet surgical marker and covered with micropore tape. At 48 hours, panels were removed and borders were re-marked; at 96 hours, the results were evaluated by a dermatologist (J.S.H.). T.R.U.E. Test templates aided in the reading of patch-test results. Grading and positive results were based on standard criteria (Table 1).⁶ Additionally, four patients were clinically rechallenged for suspected bacitracin allergy. On all four patients, an area of the forearm was treated with bacitracin and covered with a Band-Aid (Johnson & Johnson, Langhorne, PA). Readings were conducted at 48 and 96 hours, as described above. To evaluate all tested patients over the proper reading time (96 hours after the initial application of allergens) and to provide a practical, cool, and controlled environment for testing purposes, all tested personnel were kept in the hospital.

Results

Thirty patients were tested with the T.R.U.E. Test. Military personnel accounted for 70% of those tested. The average patient age was 34.4 years, and the average duration of dermatitis was 7.5 months. Fourteen patients (46.7%) had a positive test result for at least one antigen (Table 2). Overall, 12 different allergens were identified, and a total of 18 positive test results were recorded. In these positive test results, nickel, neomycin and thimerosal each comprised 17% followed by budesonide (10%). Epoxy resin,

potassium dichromate, p-phenylenediamine, formaldehyde, quaternium-15, fragrance, and balsam of Peru each yielded one positive test result (5% each). Based on history and the location of the dermatitis, all positive patch-test results were included in the final analysis (Table 3), with the exception of one patient's results. This patient, originally patch-tested for eyelid dermatitis, had four positive reactions (to nickel, thimerosal, formaldehyde, and steroid). Additionally, she developed a diffuse dermatitis during testing, and the dermatitis persisted even after the patches were removed. Her positive reactions were felt to be due to angry back,⁷ and relevancy could not be established. She was placed on an oral steroid taper, and her eruption resolved. She was not retested and was lost to follow-up.

Four patients with diffuse dermatitis were patch-tested; two had positive reactions to nickel. Nine patients with hand dermatitis were tested; one patient had positive results for fragrance mix and balsam of Peru, and two patients had positive results for budesonide. Thimerosal accounted for two "true" positive patch-test reactions among six patients tested for eyelid dermatitis. (The third patient with a positive test result for thimerosal was discussed in the previous paragraph; relevancy in her case could not be established.) Contact lens solution was the allergen source for one patient, and eye drops were the source for the second. One patient with scalp dermatitis reacted positively to p-phenylenediamine (PPD), and one patient with foot dermatitis reacted positively to potassium dichromate and epoxy resin. All of the above results were felt to be clinically relevant, given (1) the respective patients' history of exposure to potential allergens through daily product or occupational exposure, (2) the timing of their skin eruption in comparison to their exposure, and (3) the clinical experience of the evaluating physician (J.S.H.).

Four patients underwent clinical challenge and were not tested with the T.R.U.E. Test. All four were treating wounds with bacitracin antibiotic ointment and had eruptions. These patients were subjected to a use test; at 96 hours, 100% had positive use-test results for bacitracin.

The 34 patients who were subjected to both patch testing and use testing in this study were initially referred to the dermatology clinic for evaluation and possible evacuation to the United States because of their chronic dermatitis. Their dermatitis had been unresponsive to treatment and was interfering with their job duties. Of 14 patch test–positive patients, only one required evacuation to the United States; this patient had chronic dermatitis of the feet and was patch test positive for components of both

Table 1. Grading Criteria for Patch Tests

+/-	Macular erythema
+	Erythema, induration, possibly papules
++	Edematous or vesicular reaction
+++	Spreading bullous or ulcerative reaction
–	Negative reaction
IRR	Irritant morphologic appearance

Adapted from Marks J et al.⁶

IRR = irritant.

Table 2. Positive Reactions by Location

<i>Area Affected</i>	<i>Positive Patients</i>	<i>Positive Allergens</i>
Diffuse dermatitis	50% (2/4)	Nickel
Eyelid/face	33% (2/6)*	Thimerosal (2 patients), quaternium-15 (1 patient)
Foot	100% (1/1)	Epoxy resin, potassium dichromate, nickel
Hand	33% (3/9)	Budesonide (2 patients), fragrance, balsam of Peru
Scalp/face	100% (2/2)	PPD [†]
Wounds	70% (7/10) [‡]	Neomycin (3 patients), bacitracin (4 patients)

PPD = p-phenylenediamine.

*One patient with suspected angry back. This result was not included in the true positives.

[†]This patient had a history of hair dye allergy. Patch testing was performed to confirm the diagnosis.

[‡]Three patients had positive T.R.U.E. Test results, and four were use-test-positive on clinical rechallenge.

combat boots and athletic shoes. The other 13 patients' conditions were managed in Iraq by avoidance of their allergens, resulting in significant overall cost savings.

Discussion

Patch testing is the "gold standard" for diagnosing allergic contact dermatitis. History and physical examination alone, although beneficial in predicting positive test

results,⁸ are not sufficient for diagnosis. Without patch testing, allergic contact dermatitis may go undetected, resulting in increased patient costs, increased morbidity, and delay in accurate diagnosis and treatment, with a corresponding decrease in quality of life.⁹

The use of the T.R.U.E. Test in the combat desert environment is an efficient and (based on our results) a clinically relevant method of testing for allergic contact dermatitis. This testing method is preferable because it

Table 3. Positive Patch-Test and Use-Test Reactions

<i>Patient</i>						
<i>Age</i>	<i>Body Area</i>	<i>Duration</i>	<i>Suspected Allergens</i>	<i>Positive Results</i>	<i>Score</i>	<i>Clinical Relevance</i>
26	Diffuse	3 mo	Unknown	Nickel	+	Jewelry
37	Diffuse	6 mo	Formaldehyde, clothing	Nickel	+	Jewelry
41	Eyelid	2 mo	Thimerosal	Thimerosal	+	Contact lens solution
27	Eyelid	1 mo	Thimerosal	Thimerosal	+	Moisture eye drops
31	Eyelid	> 1 yr	Unknown	Nickel, thimerosal, formaldehyde, steroid	+	Status cosmeticus
36	Face	4 mo	Unknown	Quaternium-15	+	Shampoo
42	Foot	> 1 yr	K+chrom, epoxy	Epoxy, nickel, K+chrom	++	Military boots, running shoes
26	Hand	> 1 yr	Unknown	Fragrance, balsam of Peru	+	Scented hand lotions
36	Hand	3 yr	Steroid	Budesonide	+	Topical steroids
44	Hand	1 yr	Steroid	Budesonide	+	Topical steroids
27	Scalp, face	6 mo	PPD	PPD	+	Hair dye allergy
42	Surgical site	1 wk	Neomycin	Neomycin	+	Postoperative abx
46	Surgical site	1 wk	Neomycin	Neomycin	+	Postoperative abx
38	Surgical site	3 wk	Neomycin	Neomycin	+	Postoperative abx
37	Wound	6 mo	Bacitracin	Use test	+	Wound abx
37	Wound	2 wk	Bacitracin	Use test	+	Wound abx
48	Wound	2 wk	Bacitracin	Use test	+	Wound abx
23	Wound	1 mo	Bacitracin	Use test	+	Wound abx

abx = antibiotic; K+chrom = potassium dichromate; PPD = p-phenylenediamine.

involves a ready-to-use patch test kit with easily manageable storage requirements. These requirements include refrigeration between 36°F and 46°F and use within 4 hours of exposure to room temperature.¹⁰ The dermatology clinic at Ibn Sina has the refrigeration capabilities needed to meet these storage requirements. The T.R.U.E. Test is more portable than the chamber method, which can be cumbersome and which requires additional special storage and personnel considerations. Although the T.R.U.E. Test is not perfect,¹¹ owing to the austere conditions in the combat environment, the 64-allergen North American Contact Dermatitis Group (NACDG) method is not practical.

This pilot study was aimed at testing the feasibility of patch-testing for allergic contact dermatitis (ACD) in the combat environment and did not attempt to address the overall prevalence of ACD in this environment. The limitations of this study were many and included a referral bias. Only those patients who have a difficult and resistant dermatitis are referred to the dermatology clinic in Iraq. Additionally, because of the limited number of patch tests available, only 30 tests were performed. History and physical examination played a significant role in determining which patients were tested. The T.R.U.E. Test addresses only 23 allergens and has limited specificity and sensitivity. It is estimated that the T.R.U.E. Test can miss up to 40% of ACD cases and that these patients would prove positive if retested with the NACDG 64-allergen standard series.¹¹ Given the overall mission during combat and the rotating nature of the deployments, longer-term follow-up of these patients is practically impossible. The presence of irritant contact dermatitis is another confounding factor. The harsh, hot, and dry desert conditions to which our patients are subjected prove to be exacerbating factors. Patch-testing in the combat environment can be difficult owing to loss of manpower during the required 5-day testing. However, the 5-day manpower loss is minimal when compared to the average 18-day loss when evacuating patients back to the United States for definitive testing. Thus, the overall cost savings of patch-testing within the theater is a greater advantage.

Conclusions

This article outlines our pilot study aimed at testing the feasibility of patch-testing for allergic contact dermatitis in

the combat environment. We have shown that the T.R.U.E. Test can be used effectively and with good results in this environment. By identifying contact allergens, we can formulate treatment recommendations, including the avoidance of further exposure. This will allow military and civilian personnel to remain in theater in a functioning capacity and with greater cost savings than can be had with an evacuation alternative. Further study is needed to address the overall prevalence and incidence of ACD in the combat environment.

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