

## CASE REPORTS

# Allergic Contact Dermatitis to Diethylthiourea in a Neoprene Wader

M.C. Martínez-González, J.J. Goday-Buján, M. Almagro, and E. Fonseca

Servicio de Dermatología, Hospital Abente y Lago, Complejo Hospitalario Universitario Juan Canalejo, A Coruña, Spain

**Abstract.** Diethylthiourea, like other thioureas, is often used by the rubber industry and in the manufacture of neoprene. We present a patient who suffered allergic contact dermatitis to diethylthiourea in a neoprene wader and who required admission to hospital and systemic treatment. We review the literature on allergy to diethylthiourea. Thioureas are not included in the standard GEIDAC (Spanish Contact Dermatitis Research Group) battery of patch tests. In these cases, it is necessary to use a special battery of rubber allergens, which includes thiourea compounds, for diagnosis of the disease and to ensure that cases of contact allergic dermatitis to thioureas do not go undiagnosed.

**Key words:** allergy, contact dermatitis, rubber, neoprene, diethylthiourea, patch tests.

## DERMATITIS ALÉRGICA DE CONTACTO A DIETITIOUREA POR UN TRAJE DE PESCA DE NEOPRENO

**Resumen.** La dietiltiourea, como otros compuestos del grupo de las tioureas, se usa frecuentemente en la industria de las gomas y en la fabricación de neopreno. Presentamos un caso de dermatitis alérgica de contacto (DAC) por dietiltiourea en un traje de pesca de neopreno que precisó ingreso hospitalario y tratamiento sistémico y revisamos la literatura publicada de alergia a dietiltiourea. Las tioureas no están incluidas en la batería estándar del GEIDAC (Grupo Español de Investigación en Dermatitis Alérgica de Contacto). En estos casos debe utilizarse una batería especial de gomas, que contenga compuestos de tiourea, para llegar al diagnóstico etiológico de la enfermedad y evitar que los casos de DAC por tioureas queden sin diagnosticar.

**Palabras clave:** alergia, dermatitis de contacto, gomas, neopreno, dietiltiourea, pruebas epicutáneas.

## Introduction

Thioureas are used mainly as accelerators in the rubber industry and in the manufacture of neoprene, but are used in other industries as well. These compounds can lead both to allergic contact dermatitis (ACD) and to allergic contact photodermatitis. Relatively few cases of ACD have been published, and these are small series or isolated cases. We report a case of a patient with ACD to diethylthiourea in a neoprene wader.

## Case Description

The patient was a 41-year-old man, a janitor by profession, with a history of atopic dermatitis in childhood, who had been a fishing enthusiast for the past 10 years. He was admitted to hospital from our hospital's emergency department, after attending in July 2007 for a generalized impetiginized skin eruption that had begun 15 days earlier.

The symptoms had begun suddenly after a day of fishing during which he wore a specially designed neoprene wader. The wader completely covered the patient's lower limbs and lower trunk and was held up at the shoulders by means of straps made of the same material. The patient stated that the eruption had begun as erythematous nonscaly pruritic lesions on his lower limbs that had later spread to his back and arms. His family doctor had prescribed an antibiotic, an antihistamine, and oral corticosteroids. There had been initial improvement, followed by worsening and a secondary infection of the lesions due to scratching. The patient also had a mild fever on the days preceding admission.

Correspondence: María Covadonga Martínez-González  
Servicio de Dermatología, Hospital Abente y Lago  
Complejo Hospitalario Universitario Juan Canalejo  
C/ Sir John Moore, s/n  
15001 La Coruña, Spain  
covadie@yahoo.es



**Figure 1.** Eczematous lesions in the area in contact with the shoulder straps and body of the wader.



**Figure 2.** Eczematous lesions on the back of the leg, with a purplish appearance in some areas.

On admission, the patient presented an exudative erythematous skin eruption with numerous scratches on the trunk, the palms, and especially the lower limbs. The lesions located in the pretibial areas were impetiginized. In the rest of the examination, other systems and his general state of health were normal. Complete blood count and



**Figure 3.** Patch tests: diethylthiourea:++ at 96 hours.

coagulation studies, as well as electrocardiogram and chest radiograph, were also normal.

During hospitalization, the patient was evaluated by the dermatology department. A diagnosis of ACD to neoprene was suggested, based on the patient's medical history and symptoms, which included erythematous exudative maculopapular confluent lesions. The lesions were located on the specific areas that had been in close contact with the neoprene wader (Figure 1) and showed a certain purplish appearance in some parts (Figure 2). The patient was treated with amoxicillin-clavulanic acid, antihistamines, and oral prednisone (beginning at 40 mg/d), as well as topical corticosteroids (clobetasol propionate, twice daily). His symptoms improved quickly and he was discharged from hospital 4 days after admission.

He was given an appointment in the dermatology department for November 2007 to undergo patch testing with the standard GEIDAC (Spanish Contact Dermatitis Research Group) battery (29 allergens) and a battery of rubber allergens (Chemotechnique Diagnostics–Rubber Additives Series–Code R-1000). The patches were placed on his back and removed after 48 hours. Results were evaluated according to International Contact Dermatitis Research Group guidelines, with a second evaluation at 96 hours. Positivity was found only for diethylthiourea (++) in the battery of rubber allergens (Figure 3), at both 48 hours and 96 hours. This result was clearly significant, as these compounds are usually present in neoprene. Since giving up the use of garments made of neoprene and rubber, the patient has remained asymptomatic.

In the course of a later interview for another medical history, the patient mentioned that he had taken up fishing 10 years before and that he had first used waders made of rubber and then, for several years, of neoprene. The wader that led to the cutaneous reaction was new, and he had previously used it on 6 occasions before the day he had the

reaction. The weather that day was sunny, producing heat and intense perspiration under the wader.

## Discussion

Neoprene, one of the first synthetic rubbers, was first synthesized in 1930. It is used in bathing suits, gloves, insoles, adhesives, orthopedic arms and splints, masks for continuous positive airway pressure, rubber tubes and flippers for diving, protective goggles, automobile seat belts, and wrist supports for computer keyboards.<sup>1</sup>

Rubber additives, such as accelerators and antioxidants, are among the most frequent causes of occupational ACD.<sup>2,3</sup> Most rubber allergens (carbamates, thiuranes, mercaptans, etc.) are included in the standard GEIDAC battery of patch tests; thus ACD to rubber is easily diagnosed with this battery alone.<sup>2</sup> However, many other chemical products used in rubber, such as thioureas, can also cause ACD and it is therefore often necessary to use a special battery of rubber allergens for patch testing.<sup>2-4</sup>

The thioureas most often used in the industry are diethylthiourea, dibutylthiourea, and diphenylthiourea.<sup>3</sup> They are used not only in the rubber industry and in the manufacture of neoprene, but also in other types of industries—for example, as antioxidants in the printing industry, in the manufacture of paints (diethylthiourea), and as an anticorrosive in stripping solutions for metals (diethylthiourea).<sup>1,2</sup> Some thioureas, such as diethylthiourea, are carcinogenic, and for this reason industries using these products follow strict guidelines.<sup>2</sup>

There is very little information in the dermatology literature concerning the reasons for the use of thioureas in the rubber industry. It is likely that they are the most effective accelerators for the vulcanization of neoprene, although they are normally used in combination with other types of accelerators, such as thiuranes or dithiocarbamates. Such a combination of accelerators probably improves the water resistance of the finished product due to the nature of the vulcanized state it produces.<sup>2</sup>

There have been cases of ACD to the 3 most widely used thiourea compounds. Thioureas can also produce allergic contact photodermatitis.<sup>2,5,6</sup> The number of cases of ACD to diethylthiourea reported in the literature is relatively small (isolated cases and small series) and many of them are related to the use, whether occupational or not, of neoprene suits and other rubbers.<sup>1-4,7-13</sup> All the published cases of contact reactions to neoprene have been type IV allergic reactions.<sup>1</sup> We found no case of allergic contact photodermatitis to diethylthiourea in the literature.

If a patient with contact dermatitis has been exposed to products that might contain thiourea compounds (or compounds that can break down into thiourea compounds), such as rubber, polyvinyl chloride plastic or adhesives, diazo

paper, paint or glue removers, anticorrosives, fungicides or pesticides, and even commercial detergents, textiles, and fruits and vegetables (because of the pesticides and fungicides used), patch testing with these compounds is essential.<sup>2,3,12</sup> A diagnosis of ACD to thioureas should also be considered, and special tests administered, in patients with reactions to synthetic rubber, especially to neoprene (waders, wet suits for diving and surfing, knee supports, ankle supports, gloves, auto racing suits, orthopedic arms, firefighter suits, products for hermetic sealing, silver cleaners, etc),<sup>4,7,9,10,14,15</sup> and also in individuals with potential allergy to rubber in whom no reaction to the allergens in the standard GEIDAC battery was found.<sup>3</sup>

While cross reactions between the various thiourea compounds are rare,<sup>2,7</sup> a few cases have been reported.<sup>8,16</sup> As thioureas do not usually produce cross reactions, they should be tested separately.

The differential diagnosis in our patient included mainly ACD to other antigens found in neoprene (thiram, mercaptobenzothiazole, formaldehyde, dithiocarbamates, urea formaldehyde resins, isopropyl phenylparaphenylenediamine, and paraphenylenediamine),<sup>13</sup> irritant contact dermatitis, reactions to contact with water, and physical urticarias (dermatographic urticaria, pressure urticaria, cholinergic urticaria, and cold urticaria).

It is well known that ACD to thioureas shows lesions with a purplish appearance at some point, as occurred in our patient. It is also worth pointing out that the patient's symptoms became so severe that hospitalization and both systemic and topical treatments were required to control them.

We report a new case of nonoccupational ACD due to the use of a neoprene wader, and review the few published cases.

## Conflicts of Interest

The authors declare no conflicts of interest.

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