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Allergic contact dermatitis resulting from a poly(carbonate urethane) chronic haemodialysis central venous catheter

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According to a prospective study, 8% of haemodialysis patients had experienced eczema in the area of vascular access, 25% were sensitized to at least one allergen, and lidocaine–prilocaine cream was the most frequent positive allergen (1).

In the United States, central venous catheters are used in 60% of patients who are started on haemodialysis and in 30% of those on maintenance therapy. The skin-tunnelled central venous catheters (central lines) intended for long-lasting treatments have polyester cuffs that anchor the device to a subcutaneous tunnel. The catheters are composed of soft materials such as silicone, polyurethane, or poly(carbonate urethane) (2).

Case Report

A 74-year-old male non-atopic patient, with chronic kidney disease secondary to chronic tubulointerstitial nephropathy, was started on haemodialysis in March 2011 through a radio-cephalic arterio-venous fistula that had been created 5 months earlier.

Later that year, in November, a fistula dysfunction was diagnosed, and a new access site was used: a tunnelled poly(carbonate urethane) central venous catheter implanted in the internal jugular vein (Proguide Chronic Dialysis Catheter; Merit Medical Systems, South Jordan, UT, USA).

Three weeks later, the patient presented with skin lesions starting a few days after the catheter was implanted. The lesions consisted of erythematous–scaly



Fig. 1. Erythematous and scaly plaques involving the skin at the periphery of the catheter insertion site and spreading to the right side of the patient's chest.

plaques involving his right chest at the periphery of the catheter insertion site and excoriations on his upper back and limbs (Fig. 1).

Clorhexidine solution was the sole topical treatment applied before the lesions developed. Subsequent treatment included fluticasone cream and fusidic acid ointment, as well as avoidance of clorhexidine, without improvement.

The dysfunctional fistula was surgically corrected, and the dialysis treatment was restored through it in February 2012. At that point, the central catheter was removed, with complete clearance of the lesions. Three weeks before the removal of the catheter, the patient was patch tested with the series and products shown in Table 1.

Readings performed on days D2, D4 and D7 showed positive reactions, with two samples from one identical catheter (Fig. 2), to caine mix, beryllium chloride, and Amerchol® L-101. Current relevance was attributed to

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Table 1. Patch tests results

Series ^a	Readings			Relevance
	D2	D4	D7	
Standard (GEIDAC) ^b	Caine mix 0.51 mg/patch (+)	Caine mix 0.51 mg/patch (+)	–	Unknown
Cosmetics	Amerchol® L-101 50% pet. (+)	Amerchol® L-101 50% pet. (+)	–	Unknown
Metals (including tungsten)	–	Beryllium(II) chloride 1% pet. (+)	Beryllium(II) chloride 1% pet. (++)	Unknown
Plastics (including 4,4'-diaminodiphenylmethane 0.5% pet., diphenylmethane-4, 4'-diisocyanate 1% pet., phenylisocyanate 0.1% pet., toluene-2,4-diisocyanate 1% pet., and bisphenol A 1% pet.)	–	–	–	–
Fusidic acid ointment	–	–	–	–
Clorhexidine 2% aqueous solution	–	–	–	–
Micropore® Medical Tape (3M, Saint Paul, MN, USA)	+ (IR) ^c	–	–	–
Transpore® Medical Tape (3M)	+ (IR) ^c	–	–	–
Mefix® (Mölnlycke Healthcare, Gothenburg, Sweden)	+ (IR) ^c	–	–	–
Tegaderm film® (3M, USA)	–	–	–	–
Radio-opaque barium sulfate filament ^d	–	–	–	–
Cotton piece of fabric sterilized in an autoclave ^e	–	–	–	–
Ethylene oxide-sterilized cotton piece of fabric ^e	–	–	–	–
Proguide Chronic Dialysis Catheter® (polyester cuff)	–	–	–	–
Proguide Chronic Dialysis Catheter® (transparent component)	+	++	++	Definite ^f
Proguide Chronic Dialysis Catheter® (white component)	+	++	++	Definite ^f

^aAll series from AllergEAZE, SmartPractice, Canada, except for standard series (TRUE Test series, SmartPractice, Canada).

^bGEIDAC: Spanish Contact Dermatitis Research Group Series.

^cAll the tapes and dressings used in the dialysis unit except for Mefix® elicited a weak positive reaction at the reading performed on D2. This was believed to be an irritant reaction (IR), as the later readings, performed on D4 and D7, were negative.

^dAs the catheter was radio-opaque, and most radio-opaque medical devices made of poly(carbonate urethane) usually contain either a loading of barium sulfate or salts of tungsten, patch tests were also performed both with an X-ray-detectable barium sulfate filament obtained from a piece of gauze and with tungsten metal (included in the metal series), with negative results.

^eAs the catheter was ethylene oxide-sterilized, tests were performed with both a piece of cotton fabric sterilized in this way and another piece of the same fabric sterilized in an autoclave. Negative results were observed with both.

^fPatch tests with both components of the catheter were performed on 6 controls, with negative results.

both pieces of the catheter. Although the fusidic acid ointment contained lanolin, relevance of Amerchol® L-101 could not be definitely established, as the tests with fusidic ointment, as is, gave negative results. Six controls tested with samples of the catheter were negative.

The patient was thus diagnosed with allergic contact dermatitis caused by a poly(carbonate urethane) central venous catheter, possibly aggravated by the use of the lanolin-containing fusidic acid ointment.

Discussion

Only one case of contact dermatitis caused by a similar poly(carbonate urethane) dialysis central catheter has

been published so far, involving a patient who developed dermatitis surrounding the insertion site (3).

In our case, the manufacturer indicated that the catheter is composed of ethylene oxide-sterilized radio-opaque poly(carbonate urethane) polymer and a cuff made of polyester. As sensitization to both the polyester cuff and the ethylene oxide were ruled out (as shown in Table 1), the contact dermatitis was attributed to the poly(carbonate urethane) element.

Poly(carbonate urethane) is a co-polymer composed of polycarbonate (CAS no. 25037-45-0) and polyurethane (CAS no. 9009-54-5). The main polycarbonate material is produced by the reaction of bisphenol A and phosgene, has been reported to be a very rare cause of contact



Fig. 2. The tests showed positive reactions to two samples from one identical catheter.

dermatitis, which is why we believe that the reaction observed in our patient was probably attributable to the polyurethane component. Isocyanate molecules

present in polyurethane systems are known to be strong sensitizers, and can cause mucosal diseases, contact dermatitis, and urticaria (4). Additionally, sensitization to bisphenol A was ruled out (Table 1).

Patients reported to have contact dermatitis caused by polyurethane often show negative results when patch tested with isocyanates, even when, as in this case, the patient's own products give positive results. Possible reasons for this might be as follows: (i) commercially available patch test preparations of diphenylmethane-4,4'-diisocyanate (4,4'-MDI) contain lower concentrations than those stated on labels (5); (ii) 4,4'-MDI is a poor representative of the products that patients are actually exposed to, because of the high variability in composition of the industry polymers, depending on the manufacturer (5); and (iii) the use of additives is widespread in the plastics industry, and although it is very likely that the dermatitis was caused by the main component of the catheter [poly(carbonate urethane)], we believe that sensitization from potential additives cannot be completely ruled out, as individual additives were not available for full patch testing.

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