

Short Communication

Sensitization to methyl methacrylate in the plastic catheter of an insulin pump infusion set

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Key words: (meth)acrylates; allergic contact dermatitis; methyl methacrylate; pump infusion set catheter; cross-reactivity; capillary gas-chromatography with mass quadrupole detector. © Munksgaard, 2001.

Case Report

A 33-year-old woman, with diabetes mellitus, developed acute eczema on the abdomen at contact points with the catheter of a pump infusion set that she had been using for 1 year (Set Per Microinfusione[®], Pharma-Plast, Denmark). She gave a previous history of allergy to metals only.

Patch tests with the GIRDCA/SIDAPA standard series, supplemented by an acrylic resin series (Firma, Italy) with, in addition, a piece of catheter both from her pump infusion set and from an alternative Cliniset[®], gave the results shown in Table 1, in addition to a positive reaction to nickel. The catheters were then extracted and analysed.

Table 1. Acrylic resin and catheter patch test results

	pet.	D2	D3
methyl acrylate	1%	++	++
ethyl acrylate	1%	++	++
butyl acrylate	1%	++	++
isobutyl acrylate	5%	++	++
methyl methacrylate	5%	++	++
ethyl methacrylate	2%	++	++
butyl methacrylate	2%	++	++
hydroxyethyl methacrylate	5%	++	++
butanediol diacrylate	0.1%	++	++
benzoyl peroxide	2%	—	—
hydrazine hydrated	1%	—	—
hydroquinone monobenzylether	1%	—	—
resorcinol	1%	—	—
pyrogallol	1%	—	—
tricresyl phosphate	2%	—	—
triphenyl phosphate	5%	—	—
dibutyl phthalate	5%	—	—
diethyl phthalate	5%	—	—
dioctyl phthalat	2%	—	—
Set per microinfusione [®] catheter		++	++
Cliniset [®] catheter		—	—

Reagents

Methanol, tetrachloromethane, tetrahydrofuran, dichloromethane and acetone (all RP-ACS grade) were purchased from Carlo Erba (Milan, Italy). The standards, γ butyrolactone (99%), methyl methacrylate (99%) and 3-methyl-2-buten-1-ol (99%), were purchased from the Aldrich Chemical Company; dimethyl adipate (99%) from the Fluka Chemical Company.

Extraction procedure

This was based on the method described by Brookman (1). The 2 catheters were fragmented and subjected to a 54-h Soxhlet extraction with a 1:1 mixture of methanol and carbon tetrachloride. After removal of the solvent, the soluble portion of the extract (B in Fig. 1) gave a brown oil that was then washed in acetone; the insoluble portion, containing the long wax-like chain hydrocarbon

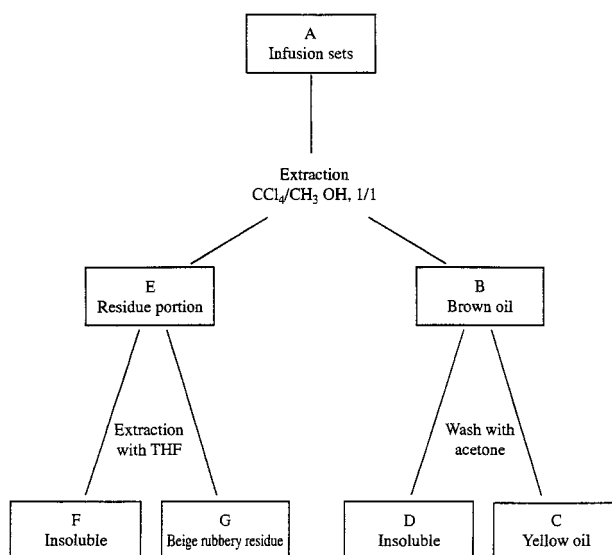


Fig. 1. Extraction procedure.

Table 2. Values of mass spectra

Infusion set	Column	Fraction	Rt min.	Attribution	m/z.	Rel. Abd. (%)
Cliniset®	HP 5% PMS	G	4.7	3-methyl-2-buten-1-ol	86*	22
					71	100
					46	53
					42	50
					86*	31
		C	6	γ butyrolactone	42	100
					56	35
					83	14
					59	100
					55	75
Set Per Micro-infusione®	HP FFAP	G	10.5	dimethyl adipate	114	50
					101	50
		G	10.5	methyl methacrylate	100*	22
					41	100
					69	65
		G	39	γ butyrolactone	99	13
					86*	31
					42	100
					56	35
					83	14

* Molecular ions.

lubricants (2–4), is labelled D in Fig. 1. The soluble fraction was evaporated and gave a yellow oil (C in Fig. 1). The Sohxelet residue portion (E in Fig. 1) was subjected to 28-h extraction with tetrahydrofuran. After removal of the solvent, the soluble portion of the extract (G in Fig. 1) gave a beige rubbery residue. The insoluble fraction, containing inorganic material (2–4), was labelled F in Fig. 1. Fraction C, containing the plasticizers and stabilizers, and fraction G, containing the resins and polymeric modifiers, after solubilization in CH_2Cl_2 , were analyzed by capillary gas chromatography with a mass quadrupole detector (GC/MS).

Analytic procedure

Chemical-physical analyses were carried out on a Hewlett Packard gas chromatograph HP 5790A with mass-selective detector (GC/MS) using an HP 5% phenyl-methylsilicone (PMS) column (Hewlett Packard 25 m $\times$ 0.2 mm i.d., 0.2 μm film thickness) and an HP FFAP column (Hewlett Packard 50 m $\times$ 0.2 mm i.d., 0.33 μm film thickness). All the analyses were carried out under: oven temperature programme, 50°C (held for 3 min) to 220°C at 3°/min, carrier gas He, pressure 20 p.s.i.; injection volume was 10 μl for all standards, and samples of final extracts. Data acquisition was controlled by a Pascal HP 9000 series 300 chemstation system.

Results

4 compounds were identified by the mass spectra obtained during the chromatographic separations. In the Cliniset® catheter 3 compounds were identified: 3-methyl-2-buten-1-ol and γ butyrolactone (fraction G, see Table 1) and dimethyl adipate (fraction C, cf. Table 2). In the Set Per Microinfusione® catheter 2 compounds were identified: γ butyrolactone and methyl methacrylate (fraction G, cf. Table 2). The mass spectra values are shown in Table 2.

Comment

Cases of allergic contact dermatitis due to acrylics in the adhesive used to attach the needle to the tubing have previously been reported in pump infusion set users (2–4), but never previously due to an acrylic in the plastic tubing itself, as in this case.

The presence of methyl methacrylate demonstrated in the catheter of the patient's own infusion set correlated with her positive patch test results. Since patch testing and chemical-physical analysis was negative for methyl methacrylate in the alternative Cliniset® microinfusion set, this was supplied to the patient for her insulin therapy and no further adverse skin reactions were reported.

Patch testing demonstrated probable cross-sensitivity between methyl methacrylate and other acrylics (5–7).

References

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