Acta derm.-venereol. 49: 501–502, 1969

SENSITIZING PROPERTIES OF P-AMINO-DIPHENYLAMINE

LEIF SCHØNNING

The Sensitizing Properties of p-Amino-diphenylamine

P-phenylenediamine (PPD) has been known for its sensitizing properties and has for decades been prohibited as a hair dye in various countries as *e.g.* Germany and Denmark, while in the United States provision has been made for epicutaneous testing before using the dye at the hair dressers.

A comparison of the results from epicutaneous testing with PPD in contact dermatitis patients has disclosed increasing sensitivity in some countries, *e.g.* the United States and Sweden (1, 3), while decreasing sensitivity is reported from other countries, (4).

In 1952 Schwartz (5) concluded that the free use of PPD as a hair dye in the United States did not offer any essential risk. Furthermore, positive reactions to patch tests with PPD may only indicate previous contact with local anesthetics, sulphonamides, aniline dyes and rubber antioxidants, thus implying a more general "para-group allergy".

When Borelli (2) first drew attention to the sensitizing properties of the new hair dye p-amino-diphenylamine (PADA), introduced during the recent years, it was decided to include this chemical in various concentrations in our standard patch test series.

Material and Method

The study was carried out on 2669 consecutive dermatitis patients examined by standard patch tests with approximately 40 different substances including PPD, PADA and p-aminophenol (PAP). The tests were applied on the front and the sides of the thighs using Lysaplast Special (R) and read 48 and 96 hours after application, and then at longer intervals. Only unquestionable reactions of erythema and papules—2 + reactions or more—were included. The patch tests with PPD and PAP were applied in the concentration 2 per cent in petrolatum.

The patch tests with PADA were applied in three concentrations: The first 554 patients were tested with the concentration 2 per cent, the subsequent 833 patients with the concentration 0.5 per cent, and the last 1282 patients with the concentration 0.25 per cent in petrolatum. The quantity of petrolatum applied was in all cases approximately 0.04 ml, which makes the quantity of hair dye in the 2 per cent concentrations about 0.8 mg.

Results

The results from the tests with the three hair dyes appear from Table 1. The term "delayed reactions" implies reactions observed 7 days or later after the application. It appears from the table, that the percentage of positive reactions to PADA decreases as the concentration of the hair dye is reduced, and not until a concentration of 0.25 per cent does it reach the level of the hair dye PPD, used in a concentration of 2 per cent. The difference is still more striking considering the number of produced sensitizations with the two hair dyes.

Department of Dermatology (Head: Holger Brodthagen, M.D.) Finsen Institute, Copenhagen, Denmark.

Table 1. *The results of patch testing of consecutive dermatitis patients with three hair dyes. Vehicle: Petrolatum*

Hair dye	Test conc. (per cent)	Number of patients tested	Total number of positive reactions		Number of delayed reactions (sensitizations)	
			absolute	per cent	absolute	per cent
p-amino-diphenylamine (PADA)	2	554	30	5.4	17	3.1
p-amino-diphenylamine (PADA)	0.5	833	35	4.2	7	0.8
p-amino-diphenylamine (PADA)	0.25	1282	25	2.0	2	0.2
p-phenylenediamine (PPD)	2	2669	56	2.1	1	<0.1
p-aminophenol (PAP)	2	2669	18	0.7	0	0

The risk of sensitization appears to be considerably less as the concentration of PADA is reduced, but by a comparison the sensitizing properties of PADA are considerably higher than those of PPD.

PAP 2 per cent in petrolatum caused fewer reactions, and among the 2669 patients no sensitizations occurred.

Comments

The sensitizing properties of PADA compared with those of PPD seem remarkable.

The low number of sensitizations with PPD in this study (1 case among 2669 patients) seems to be in contrast to the results of Skog (6), who found 1 case in 48 patients to be sensitized with 2 per cent (total 0,2 mg) and 4 cases in 44 patients to be sensitized with 8 per cent (total 0,8 mg) PPD in petrolatum. However, the two studies are not directly comparable. Skog applied the tests on the back thus involving pressure on the tests.

In all circumstances the different results emphasize the necessity and desirability of introducing a standardisation of the conditions under which patch tests are carried out. Otherwise comparisons between various clinics and various countries are not possible.

SUMMARY

Judged by the incidence of flare-up reactions to patch tests the sensitizing properties of p-amino-diphenylamine seem considerably higher than those of p-phenylenediamine.

The incidence of dermatitis from hair dyes does not warrant any further prohibitions, but rather statement of the contents of a hair dye on the lackage and regulations as to the maximal concentrations employed.

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