

ERYTHEMAL AND PIGMENTARY PHOTOTEST REACTIONS IN POLYMORPHIC LIGHT ERUPTIONS

Christer T. Jansén

Department of Dermatology, University of Turku, Turku, Finland

Abstract. The erythematous and pigmentary skin reactions in 110 patients with chronic polymorphic light eruptions (PMLE) and in 154 control persons were investigated by phototesting with a medium pressure mercury lamp. Recording the erythematous threshold (MED) at 2-h intervals for up to 24 h after irradiation disclosed no differences between PMLE patients and controls. There was, however, a tendency for the erythematous reaction to subside more slowly in the PMLE patients; this tendency reached a statistically very significant level by day 7. Seventy-three per cent of the PMLE patients and 86% of the controls showed immediate pigmentation. Three days after irradiation, however, 91% of the PMLE patients showed a delayed pigmentary response, in contrast to 66% of the controls; the depth of pigmentation was also greater in the PMLE patients. This study demonstrates that although PMLE patients and healthy controls, taken as groups, may show some differences in their erythematous and pigmentary response, the measurement of these reactions is of no immediate assistance in the diagnosis of individual cases of polymorphic light eruptions.

Key words: Phototesting; Erythema; Immediate pigmentation; Delayed pigmentation; Polymorphic light eruption

Polymorphic light eruption is the most common photodermatosis encountered by the dermatologist. In the absence of any diagnostic chemical laboratory test, however, the diagnosis of PMLE is basically established by means of exclusion, often resting on circumstantial evidence only. In some centres, skin phototesting is used for the positive identification of PMLE, but the phototest methods and the criteria for evaluation of the results vary considerably. The reported data are furthermore controversial. Thus, abnormal erythematous thresholds (MED) to irradiation with mercury or xenon light sources have been found in PMLE patients by some investigators (6, 7, 13, 24, 25, 26) but not by others (1, 2, 8, 15). Similarly, abnormal pigmentary reactions have been described by some authors (16, 22), while others have failed to note this (20). The present study was designed to analyse the patterns of

erythematous and pigmentary phototest reactions in a large number of PMLE patients, in order to delineate any characteristic deviations from the normal reaction pattern, and to evaluate the diagnostic usefulness of these reactions.

MATERIAL AND METHODS

Patients and controls

One-hundred and ten patients with polymorphic light eruptions and 154 control persons participated in the study. PMLE was defined as a recurring pruritic summer eruption, confined predominantly to exposed skin, precipitated by sun exposure, and unrelated to the intake of any photosensitizing drugs or topical photosensitizers. To exclude other diseases with light sensitivity such as the porphyrias and lupus erythematosus, appropriate laboratory tests were made, including the antinuclear antibody test, erythrocyte protoporphyrin measurements and urinary and fecal porphyrin estimations. The age of the PMLE patients varied from 6 to 72 years, with a mean age of thirty-eight, and the mean duration of their photosensitivity was 10 years. The patients stemmed from a larger series of PMLE patients whose morphological features and clinical history have been detailed elsewhere (11, 12).

One part of the control persons (group 1) consisted of 128 healthy medical students, aged 20–28 years; 68 of them were females. The other 26 persons (group 2) were dermatological patients, unaware of any itching summer dermatosis, not suffering from atopic dermatitis or psoriasis, and with neither disorder nor topical treatment of the skin of their back. The ages of the group 2 controls varied from 16 to 62 years, with a mean age of 37 years; 10 of them were females. Informed consent for participation in the light testing was obtained from all the control persons.

Light testing

The light source consisted of four 300 W medium pressure mercury lamps (Osram Ultra-Vitalux GUR 53). To ensure an even irradiation, four lamps were mounted with their bases in the corners of a square with sides 40 cm in length. The distance from the lamps to the tested skin area was 40 cm; at this distance the output of the apparatus is less than 20 $\mu\text{W}/\text{cm}^2$ in the UVC-region, 650 $\mu\text{W}/\text{cm}^2$ in the UVB-region, and 2000 $\mu\text{W}/\text{cm}^2$ in the UVA-region (14).

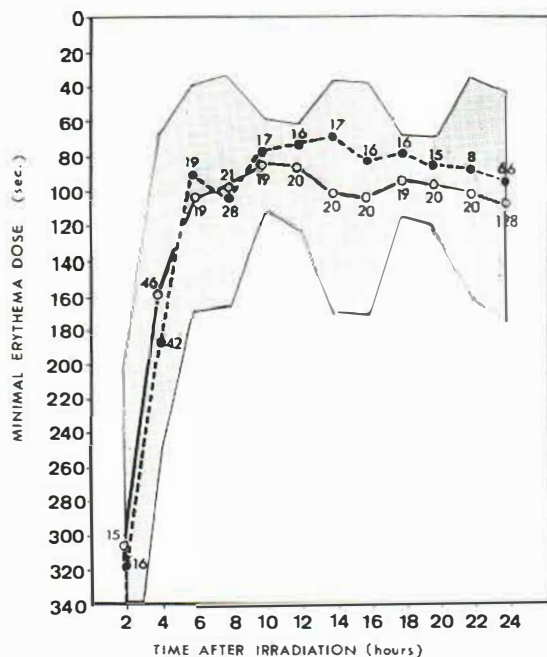


Fig. 1. Evolution of the erythema reaction during the first 24 hours after irradiation. The unbroken line refers to the healthy controls, the shaded area indicating one standard deviation. The broken line refers to PMLE patients. Numerals relate to numbers of persons.

All light tests were made on the skin of the upper back. The patient was protected by a wooden screen with an opening of 30 cm×30 cm. To provide sharply delineated test sites, an adhesive coverpaper with 1 cm² rectangular holes was applied to the skin. Appropriate exposure times were obtained by covering test sites with pieces of opaque adhesive tape. Exposure times of 10, 20, 30, 40, 50, 60, 80, 100, 120 and 140 sec, 3, 4 and 6 min were used; in many cases 8 and 10 min exposures were included. Measurements with an electrical temperature meter ensured that the skin temperature during exposure did not exceed 38°C.

Reading of skin reactions

The minimal erythema dose (MED) was defined as the shortest time of exposure which evoked an even erythema of sufficient intensity to make at least three of the corners of the irradiated skin site distinctly visible (27). To standardize the test conditions, most irradiations were made between 8 and 10 a.m. In 66 PMLE cases the MED was read at 24 h, in others at 2 or 3 days. Sometimes multiple readings were obtained at daily intervals. Some of the patients and controls participated in a special experiment where readings were taken at 2-h intervals for 12 hours; at 12 hours (in the evening) a new light test was made which was read at 12 hours post-irradiation (in the morning), and thereafter at 2-hour intervals up to 24 h post-irradiation. Thus, the whole range of 24 h for erythema development was covered at 2-h intervals.

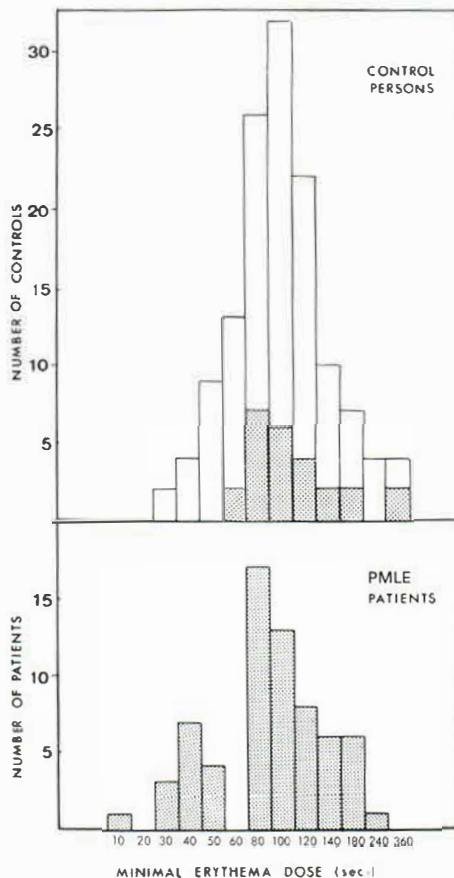


Fig. 2. MED-values at 24 hours after irradiation in 128 controls (upper part of figure) and in 66 PMLE patients (lower part). In the upper figure, the unshaded parts of the bars refer to control group 1 and the shaded parts to control group 2.

Pigmentary reactions were read immediately after irradiation (0 h) for immediate pigmentation, and 3 days after irradiation to register delayed pigmentation. The degree of pigmentation was recorded in the site irradiated for 6 min by making the skin anemic by pressure from a glass spatule, and grading the observable pigmentary response visually into four classes, where 0 denoted no pigmentary reaction, 1 barely visible but unquestionable pigmentation, 2 medium brown pigmentation, and 3 dark brown pigmentation.

RESULTS

Erythema reaction at 0–24 hours

Fig. 1 shows the development of the erythema response registered at 2-hour intervals during the first 24 h after irradiation. No major differences are seen

Table 1. Mean values and standard deviations (S.D.) for the minimal erythema dose (MED), in seconds, 2 to 7 days after irradiation

NS=not significant

Days after irradiation	PMLE patients			Controls			Statistical significance ^a
	No.	Mean MED	S.D.	No.	Mean MED	S.D.	
2	43	152	54	62	202	112	$p < 0.05$
3	69	207	96	59	228	104	NS
4	15	197	86	40	277	158	$p < 0.05$
7	8	249	94	40	499	264	$p < 0.001$

^a Student's *t*-test.

between the PLME patients and the controls. In both groups, the erythematous reaction increases in strength until a plateau is reached at 6 hours and maintained until 24 hours. At 10 to 24 hours the erythematous threshold of the PMLE patients is somewhat lower than that of the controls, but the difference does not reach statistical significance.

Fig. 2 shows the distribution of the MEDs in the PMLE and control groups at 24 h. For both the PMLE patients and the controls a median MED value of 100 sec was obtained, and no major differences were seen in the range or distribution of the MED values. Certain differences were noticed, however, between the different morphological subtypes of PMLE. Thus, in the eczematous subgroup (13 patients) the mean MED at 24 hours was 72 sec, in the vesicopapular subgroup (24 patients) it was 93 sec and in the prurigo-like subgroup (12 patients) it was 130 sec; in the remaining 17 patients, representing other morphological subtypes, the mean MED was 97 seconds. There was, however, considerable overlapping in the distribution of the individual patients' MED values.

Erythematous reaction at 2-7 days

In some PMLE cases and some of the controls the MED was registered at 2-7 days after irradiation. As seen in Table 1, there was a tendency for the erythematous reaction to subside more slowly in the PMLE patients; this tendency reached a statistically very significant level by day 7. Although the erythematous reaction at day 7 was registered from 8 patients only, these may be regarded as a representative sample, as they included six different morphological subtypes.

Pigmentary reactions

For 46 PMLE patients and 42 controls data were available both on immediate (0 h) and delayed pigmentation (3 days). Seventy-three per cent of the PMLE patients and 86% of the controls displayed immediate pigmentation. As seen in the left part of Fig. 3, the depth of pigmentation among the PMLE patients was less than that in the controls (mean values 0.8 and 1.3, respectively). Three days after irradiation, however, 91% of PMLE patients showed pigmentation, compared with 66% of the controls. The mean pigment score at 3 days was 1.5 for PMLE patients and 1.0 for the controls (Fig. 3, right part).

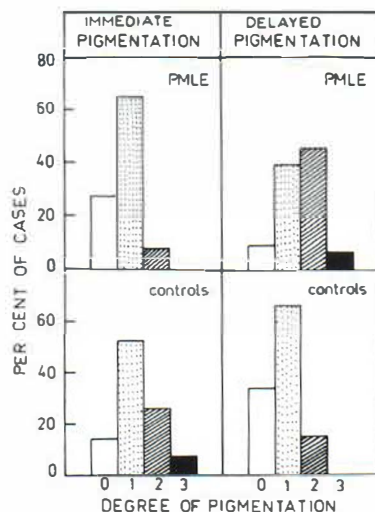


Fig. 3. Score distribution for immediate (left fields) and delayed pigmentation (right fields) in 45 PMLE patients and 42 controls.

DISCUSSION

Many investigators have measured the erythema threshold at 8 or 24 h in PMLE patients, but the conclusions arrived at are controversial. While some authors found a lowered erythema threshold in about every third case (13, 26), in every second case (6, 7, 25), or in all of the cases (24), others have recorded a normal MED in all patients (1, 2, 8, 15). The present study conforms to the findings of the latter investigators. The MED was found to vary greatly from one patient to another, though no more than in a control population. The development of the erythema reaction over the first 24 hours was furthermore found to be identical in PMLE patients and controls. Interestingly, however, differences in erythema reactivity were noted between the different PMLE subgroups. The present findings conform with those of previous investigators who have noted that low MEDs prevail in eczematous patients (5, 23) and that high erythema threshold is found in patients with prurigo-like PMLE (4, 9, 17, 20, 23).

In contrast to the similarity of the erythema reaction in PMLE patients and controls during the 24 first hours, significant differences were noted when the erythema was registered for up to 7 days after irradiation. Delayed erythema reactivity in PMLE has originally been described by Schaffer et al. (22), who claimed that it took 7–14 days for the erythema to fade in PMLE patients, compared with 3–5 days in controls. Recently, other authors have commented on the prolonged duration of erythema reactions in PMLE (18, 21). The diagnostic value of this reaction pattern is still unsettled, however, and similar reactivity has been noted in other cases of light sensitivity, i.e. in lupus erythematosus (3) and in xeroderma pigmentosum (19).

Earlier reports on the immediate pigmentation in PMLE patients are controversial. Epstein (6) noted an immediate pigmentation in only one out of five patients, and of Wiskemann & Wulf's (26) fifteen patients only three showed this reaction, as opposed to 108 out of 110 control persons. Scott & Molhuysen (23), on the other hand, claimed that there were no differences in the immediate pigmentation rate between PMLE patients, control persons, and patients with lupus erythematosus. The present study indicates that immediate pigmentation does occur slightly less often in PMLE patients than in controls, and that the pigmentary response,

in addition, is weaker. The observed differences are of no diagnostic value, however.

It has also been claimed that PMLE patients are defective in their delayed pigmentary response. Haxthausen (10) noted this phenomenon in the sites of PMLE rash, and Levy et al. (16) and Schaffer et al. (22) claimed that defective delayed pigmentation occurred in phototest skin sites. By contrast, Rotter (20) found normal pigmentary reactions upon phototesting. In the present study, no deficiency was found in delayed pigmentary reactivity. In fact, the PMLE patients displayed a slightly stronger delayed pigmentation than the controls.

On the whole, the results of the present study indicate that neither the 24 h erythema reaction nor the immediate or delayed pigmentary reactions provide any diagnostic hallmarks in individual cases of polymorphous light eruption. An evaluation of the possible diagnostic usefulness of recording a later (7 day) erythema threshold must await further investigation.

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Chr. Jansén, M.D.
Department of Dermatology
University of Turku
SF-20520 Turku 52
Finland