DERMATITIS DUE TO INVISIBLE INK*

REPORT OF A CASE

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It is the custom at some of the private swimming pools and beaches in the vicinity of New York City, and probably elsewhere, to stamp the forearms of their patrons, when they temporarily leave the premises, with "invisible ink" for the purpose of identification. When the patron reenters the swimming pool grounds, his forearm is inspected under a filtered ultra-violet light, called "Black Light", whereupon the stamped area fluoresces brightly. In spite of exposure of many thousands of individuals to this practice no case of dermatitis such as reported in this paper has been observed by us until now; and no such case is mentioned in the literature, as far as we know. We, therefore, believe that this case of persistent, localized dermatitis due to the application of invisible fluorescent ink is worthy of reporting.

CASE REPORT†

M. G., an Italian-American girl, aged 9, registered at the New York Skin and Cancer Unit, on January 8, 1948. She complained of an eruption which had been present on the right forearm for three months. The following history was obtained from the parents: On August 16, 1947, while attending a private swimming pool at a New York beach, the patient, on leaving the premises, was stamped on the right forearm for the purpose of identification. Upon her re-entering the gates, the forearm was exposed to a "black light" and she saw the letters "A.I." fluoresce brightly. The patient was exposed to this identification procedure only once, as this was her only visit to the beach during the summer of 1947. During the following two months the patient did not notice any abnormal subjective sensations or objective changes in the skin. About the middle of October, 1947, she awakened one morning complaining of an itching sensation on the right forearm. Upon inspection by the mother two bright red, raised letters—A.I.—were seen, which obviously corresponded to the letters stamped two months previously with invisible ink. After about one week the pruritus subsided but the eruption has persisted up to the present (April, 1948) with hardly any change.

We learned by questioning the mother that the child had not come in any known contact with fluorescent dyes prior to the identification stamping, nor since then. The past history of the child did not reveal any previous skin trouble. Since the age of two she had had attacks of asthma which were found to be due

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to various foods (the cabbage family, berries, bananas, celery and mustard). Observance of corrected diet had been of benefit in decreasing the frequency of the asthma attacks. The family history was irrelevant.

Examination on January 8, 1948, revealed the presence of a localized eruption on the flexor aspect of the right forearm, consisting of two bright red, raised letters —A.I.—each about one inch in length (Fig. 1). When last seen, on April 5, 1948, the eruption had hardly changed in intensity since its appearance five months previously.

The histologic findings, as reported by Dr. Charles Sims were as follows:

The epidermis is somewhat irregular and is covered with a slightly thickened horny layer composed of loose horny lamellae. The rete pegs are slightly acanthotic in several areas and are in general quite irregular. Cellular edema of the lower rete and the basal cell layer may be observed at many points. A mild exocytosis is noted. In the papillary and subpapillary zones, there is a mild localized and diffuse cellular reaction which consists of small, round cells and scattered wandering connective tissue cells. There is also a mild parenchymatous edema of the collagen in these zones. The vessels of the cutis are dilated, particularly those of the papillary and subpapillary layers. These features are compatible with the diagnosis of contact dermatitis.

Upon inquiring of the bathing establishment as to the source and nature of the ink, we were referred to the manufacturers from whom the ink was procured. The manufacturer to whom we then turned, furnished us with descriptive literature and a sample of the invisible ink. In these pamphlets the use of the invisible ink was recommended for “ballrooms, dance halls, swimming pools, rinks, and other amusement and recreation centers”. The pamphlets advertised also their “Black Light” which had to be hung at the pass-out door of the establish-

Fig. 1. Photograph of arm of patient M. G., on March 26, 1948. This eruption in shape of bright red, raised letters, A.I., appeared two months after stamping of forearm with invisible ink, on August 16, 1947.
ment. In spite of our repeated requests, the manufacturer refused to divulge the chemical composition of the ink.

Inspection of the ink revealed it to be of a pale amber color with the surface of the liquid showing a faint blue glow which was reflected in the glass of the bottle. Under the mercury arc lamp the yellow color and the blue surface-glow became somewhat more intense. Under the filtered ultra-violet light (Wood's light) there was seen a brilliant golden-yellow fluorescence. The eruption itself, however, failed to show any fluorescence under the Wood’s light. On application of the ink to the skin of the forearm fluorescence was noticed with the Wood’s light which persisted for about 24 hours.

In searching for the chemical components of such invisible inks we found two publications, one by De Ment and Dake (1), the other by Bennett (2). The former gives three kinds of chemical formulas; one, of anthracen in 4%-5% solution in benzene, giving a bright yellow-green fluorescence; a second, of beta-naphthol in water alcalized with NaOH, giving a bluish fluorescence; and a third formula consisting of beta-oxynaphthionic acid in diluted NaOH solution producing a green-yellow fluorescence.

In Bennett’s Chemical Formulary (2) we found two more formulas for “Invisible Pass-Out Ink”; one composed of saturated aqueous alcoholic solution of beta-methyl umbelliferone producing a bluish fluorescence, and another consisting of an alcoholic solution of tumeric, yielding a yellowish fluorescence.

Dr. Maurice Bruger of the Chemistry Laboratory of the New York Post-Graduate Hospital, examined the available sample of the invisible ink for the presence of mercury, but did not find any.

On March 26, 1948, we patch-tested the patient in the upper gluteal area with the ink, and also with eosin which we at that time thought might be present in the ink. Forty-eight and 96 hours later no reaction was noted. The patch-tested areas were then exposed to a suberythema dose of ultra-violet light. Again no reaction was noted.

In order to repeat approximtely the stamping procedure, the invisible ink was applied under pressure by means of the eraser end of a pencil to the skin of the gluteal region and to the area of the eruption on the forearm, between the two letters. In addition, a scratch test with the ink was made in the gluteal region. All of these tests proved negative.

On April 5, 1948, the “I” letter of the eruption was exposed to a suberythema dose of ultra-violet light, the right half of the “A” letter was covered with the ink, and the left half of the “A” was undisturbed, serving as a control. No reaction to these tests was noted within 48 hours.

**COMMENT**

The unusual feature of this case are: first, the appearance of the dermatitis limited to the letters stamped on the forearm as late as two months after the contact with the ink; secondly, the persistence of the dermatitis for more than five months, at the time of this report.

This case may well be one of sensitization to a chemical agent contained in the
invisible ink which was introduced into the skin. It apparently presents the phenomenon of so-called “spontaneous flare-up” as discussed in detail by Sulzberger (3) in his sensitization experiments with 1-2-4 dinitrochlorobenzene and other dyes and dye intermediates. He observed that the flare-up occurred from 5–6 days up to 20 days after exposure of the skin to the chemical. In our case the unusually long period of two months elapsing between the introduction of the sensitizing agent and the appearance of the dermatitis is striking. It brings to mind the observations made in cases of sensitization to mercury in tattooed individuals. For in these cases the patients were tattooed many months to years prior to the onset of the dermatitis (4, 5, 6, 7, 8). It seems to us that the best explanation of the mechanism in our case is that the sensitizing agent was introduced by the stamping into the skin and remained there, producing gradually sensitization of the impregnated skin tissue. This is analogous to the observations made in tattoo cases in which no other history of contact with mercury could be elicited and in which spontaneous sensitization to the metal must be assumed to have been caused by the cinnabar deposited in the tattoo (4, 5, 6, 7, 8). There is however, a discrepancy between our case and some of those of tattoo flare-ups, namely that in the latter, patch-tests with some form of mercury often proved positive, even in the skin distant from the area of the tattoo, while in our case the patch-test was negative even in the area of the eruption. However, in the majority of cases of tattoo, the patch tests with cinnabar itself, were also negative; and in a recent case report (7) it was evident that the hypersensitivity to mercury was diminishing and tending to disappear.

As to the long persistence of the dermatitis, the analogy to mercury sensitivity in tattoo cases is still applicable. For localized dermatitis in the red tattoo areas has been observed from one month up to seven years.

A negative response to patch test on a site distant to the eruption has been reported in cases of lipstick cheilitis and dermatitis (9). However, we are at a loss to explain the absence, in our case, of a reaction even in the area of the eruption itself. Due to the poor cooperation of the patient we were unable to investigate the reaction of the patient to the chemical components of invisible ink as given in the two publications mentioned above (1, 2). This might have possibly thrown some light on this case.

SUMMARY

1. A unique case of localized dermatitis produced by invisible ink employed for identification purposes is reported.

2. The delayed appearance of the dermatitis, its strict limitation to the stamped letters, its long persistence and the negative response to skin tests for allergic hypersensitivity were the striking features.

3. As possible explanation of the mechanism in this case, the authors consider an allergic “spontaneous flare-up” phenomenon and see a resemblance to sensitization to mercury observed in cases of tattoo.

4. This report should serve the useful purpose of calling attention to the fact
that this procedure of identification by the use of invisible ink is not entirely harmless.

REFERENCES


