UVA-induced tumours in pigmented hairless mice and the carcinogenic risks of tanning with UVA

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Summary. An animal experiment is presented in which two groups of pigmented hairless mice were exposed daily to suberythemal doses of UVA to study tumourigenesis. The aim of the study was to estimate the carcinogenic risks of tanning by UVA. The pigmented hairless mice, Skh-hr2, were separated by selective breeding into two groups, the “browns” and the “blacks”. Both groups were exposed daily to UVA from fluorescent UVA lamps (Philips TL40W/09) purified by rigorously filtering out the shorter wavelengths. No acute actinic damage was observed after any exposure. However, in most UVA exposed animals, especially in the blacks, a marked scratching preceded the development of tumours. Hyperkeratosis was also observed. All animals developed tumours. Histopathologically at least 60% of the tumours were squamous cell carcinomas. Depositions of melanophages were observed, but no melanomas. It is beyond any doubt that UVA is carcinogenic in laboratory animals. The present state of knowledge justifies no preference for tanning with UVA over tanning with UVB.

Key words: UVA-radiation — Tanning — Carcinogenesis

Materials and methods

Mice

The experiments were performed on pigmented hairless mice. The mice, males and females, entered the experiments at the age of about six weeks. The mice were kept individually separated in cages which were subdivided into 12 compartments; they had free access to “mouse chow” and tap water. The mice were subjected to dorsal exposures of UV radiation from sources situated above the cages.

Two groups of mice, “blacks” and “browns”, were exposed daily to UVA. These black and brown mice were attained by selective breeding for colour from the original stock Skh-hr2, generously supplied by The Skin and Cancer Hospital, Philadelphia, USA. Neither the black nor brown pigmentation in the mice, which was most obvious in ears and tails, was very marked. It slightly increased by the regular exposures. Eight blacks and 16 browns were subjected to the UVA regimen. The relevant genetics of the different strains are given in Table 1. Included are the genetics of the albino hairless mice, Skh-hrl, used in the previous experiments on UVA carcinogenesis [3, 16].

Radiation source

The UVA source was a bank of Philips TL40W/09 fluorescent UVA tubes. A specially selected 10-mm-thick glass filter was used to filter out all UVB rigorously. The filter also absorbed much of the shorter

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wavelength UVA (Fig. 1). The experimental set-up used in our department for animal experiments on carcinogenesis has been described in more detail previously [2, 15].

Observations

All skin reactions were assessed regularly. The tumour locations were mapped and recorded for each animal separately. With each check-up date, newly appeared tumours and changes in tumour diameter and height were recorded. Records were also made of newly damaged skin, caused by scratching, and of hyperkeratosis. When an animal had developed tumours larger than 4 mm in diameter it was taken out of the experiment.

Histopathology

After termination of the experiments the animals were sacrificed, and samples of the larger tumours were excised and sectioned for histopathological examination. The samples were fixed for 24 h in Lillies AAF (formaldehyde 10 parts, glacial acetic acid 5 parts, absolute ethyl alcohol 85 parts), routinely processed and then embedded in paraffin. Five-micrometer-thick sections stained with haematoxylin-eosin were examined.

Results

All mice, blacks and browns, exposed daily to suberythemal doses of UVA, developed tumours. In a previous experiment on UVA carcinogenesis performed with the albino hairless mice, Skh-hr1, we noticed clinical differences in the reactions of the skin in the mice exposed to UVA compared with the reactions in those exposed to UVB. On the mice exposed to suberythemal doses of UVB the first tumours usually appeared on apparently normal skin and scratching did not start before several tumours had developed. However, in the mice exposed to UVA marked damage caused by scratching was observed well before the appearance of the tumours. The scratching without any preceding effect such as redness was prob-