Introduction

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The relationship between sun exposure, UVA lamps and risk of skin cancer is considered on the basis of scientific data obtained from different fields of investigation. Epidemiological studies clearly indicate the existence of a group of people with pale skin, who burn easily, tan poorly and have a large number of naevi on their that skin are at greatest risk of developing all types of skin cancer, including cutaneous melanoma. To understand why these individuals are at high risk and to plan preventive action, a multidisciplinary study must be designed to: (1) identify objective criteria to define ultraviolet radiation (UVR) susceptibility traits with respect to type of melanins, redox state of glutathione; (2) identify DNA repair capacity, susceptibility to immunosuppression and to investigate how these criteria correlate with each other and with the risk of skin cancer; (3) incorporate molecular biology investigations and (4) assess the role of photoprotection of melanins and sunscreens. On the basis of present knowledge the board agreed that campaigns aimed at stressing the danger of excessive sun exposure should be addressed to the subjects at risk. Campaigns addressed to the entire population should be discouraged. Secondary prevention campaigns should be encouraged provided that they include elements that will allow the assessment of the efficiency of the campaigns.

REASONS FOR the great interest in the aetiology of skin cancers include the facts that no major advances have been made in the last 20 years in the management of these diseases, and at present early diagnosis is the only tool that justifies the consistent increase in survival rates of melanoma patients in the last two decades.

In this report, the greatest attention will be devoted to cutaneous melanoma because both basal and squamous cell carcinomas have lower biological aggressiveness and may be cured by minor surgical procedures carried out in the dermatologists' office. Incomplete cancer registration of non-melanoma skin cancer makes epidemiological studies difficult. With this limitation, data from nine registries in Italy confirm this statement: the ratio of mortality/incidence for cutaneous melanoma varies from 13 to 62%. The same ratio for skin cancers varies from 0 to 14% [1]. The principal risk factors for non-melanoma skin cancers are similar to those identified for cutaneous melanoma (see page 557). These observations make epithelial skin cancers and cutaneous melanoma similar when aetiology of these diseases is discussed. The limited number of studies on UVA lamps, the spectral diversity of these sources and the contradictory results reported prevent meaningful discussion of this topic. It was, however, emphasised that there is a significant exposure of humans to UVA light because of the increasing use of high-power UVA irradiation devices for medical and non-medical purposes.

Melanoma has a high potential biological aggressiveness: the chance of cure, which is 100% for level one melanoma, reduces with increasing maximum tumour thickness [2, 3] according to Breslow [4]. The treatment of cutaneous melanoma is surgical: the width of excision shoud be 1 cm borders, if Breslow's thickness is not greater than 2 mm, and 3–5 cm for thicker tumours [5, 6]. Regional node metastases also need "radical" surgical treatment [7].

The efficiency of adjuvant treatments (arterial limb perfusion in high risk stage I melanoma of the limbs, and low dose interferon in patients with regional node metastases) is under evaluation by means of international multicentric clinical trials.

Patients with distant metastases should be entered into trials of chemotherapy, possibly associated with low dose recombinant interferon [8]. Newer immunological approaches such as interleukin-2 (IL-2), tumour necrosis factor (TNF) and genetic therapies are still highly experimental.

A recent report from Scotland [9] shows a reduction of thick melanomas (greater than 3.5 mm) in females and a consequent reduction of mortality following the secondary prevention campaign. In Italy it has been shown that, following a secondary prevention campaign, the number of patients with curable melanoma doubled and the increase in mortality in this area is significantly lower than in the neighbouring regions where campaigns were not organised [10].

As far as primary prevention campaigns are concerned, there is no evidence at present of a reduction in the incidence of cutaneous melanoma (see page 557).

In facing the problem of the relationship between sun exposure (UVA lamps) and skin cancers (mainly cutaneous melanoma), we decided to summarise the state of the art, not only on the basis of epidemiological studies, which indicate that a subsection of the European population is at greater risk of getting skin cancer, but also by taking into consideration the latest results obtained in other fields of investigation (photoimmunology, biochemistry of melanins, genetics and molecular biology, photoprotection). This multidisciplinary approach suggests studies that need to be planned to identify subjects at greater risk and to understand the complex relation between sun exposure and skin cancer.

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STATE OF THE ART

I. Sun Exposure, UVA Lamps and Risk of Skin Cancer: Epidemiological Studies

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AWARENESS OF the complex association between skin cancer and solar exposure has significantly increased over the last few decades in the international epidemiological community. This is due to the steep upward slope of incidence trend, particularly in the case of malignant melanoma of the skin [1–4].

Although sharing the same site of origin, histological types of skin cancer differ in both epidemiological and clinical characteristics, and in their relationship with aetiological determinants. There is general agreement that basal cutaneous carcinoma (BCC) and squamous cutaneous carcinoma (SCC) have different characteristics. They both differ substantially from cutaneous malignant melanoma (CMM). Lentigo malignant melanoma (LMM) should be considered separately since it has a clearer association with sun exposure than other cutaneous melanomas.

Unfortunately, comparing epidemiological findings from routine data is not always straightforward. Some authors showed that even incidence data from cancer registries were under estimated because of under reporting [5]. The under reporting of non-melanoma skin cancer has been more than a problem for epidemiological studies. This is because there is a continuing tendency to diagnose a proportion of these lesions clinically, and to then treat them with non-excisional techniques such as liquid nitrogen, diathermy interferon or 5-fluorouracil. As a consequence, *ad hoc* studies have been carried out in the U.S.A. and Australia, involving additional reporting from general practitioners, out-patient clinics and specific population surveys [6–10].

Under reporting may also be related to the location of the tumour on the body. This could affect the findings from studies which reported that BCC, SCC and LMM occur more frequently on exposed body parts like the head, the face and the limbs, while CMM occurs mainly on the trunk and the extremities [11]. Indeed, the Australian survey in Geraldton showed a striking difference between prevalence and incidence data. The majority of prevalent BCC were on the trunk, whereas the majority of incident BCC were on the face, the neck and the upper limbs. This suggests that there is a significant amount of BCC on the trunk that does not come to medical attention.

Considering those studies with multiple data sources, some patterns clearly emerge.

Non-melanoma skin cancers

It is general knowledge that both BCC and SCC incidence rates are higher in males than females, vary with latitude and are low in non-Caucasians. Observations of Australian immigrants indicated that BCC and SCC incidence rates are higher for immigrants with northern European origins than those from the south [12]. Other studies revealed that people holding outdoor occupations such as fishing and farming showed high incidence rates compared to those with indoor occupations [13]. Animal models suggest that cumulative life-time exposure to ultraviolet radiation is the major risk factor for squamous cell carcinoma, and that this can be accelerated by therapeutic immunosuppression.

For elucidating the role of solar exposure and its interaction with skin pigmentation, it was necessary to rely on the limited number of published studies available up to now [14–18]. These publications revealed the following: principal host risk factors are skin reaction to sun exposure (tendency to sunburn), pigmentary traits (fair complexion, light hair colours), and ethnic origin (northern Europe). Controlling for the effect of host factors, cumulative solar exposure, as measured as time spent in outdoor activities, had a limited association to BCC and SCC. Even for individuals working outdoors, the relative risks (RR) ranged between 1.5 and 1.6. A recent report from a case–control study indicated that intermittent sun exposure, mainly associated with outdoor sports, also increased significantly the risk for SCC and BCC (RR 1.5) [19].

Results from the Australian case–control study suggested a direct association between skin cancer and sun exposure. Their findings were based on subjects with keratoses and elastoses.