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Ultraviolet Light

Key words: Melanoma, skin cancer, ultraviolet light.

Introduction

In addition to supporting life on earth, sunlight is critical to human physical and psychological well-being. Excess exposure of the skin to sunlight, however, causes skin cancer. The vast majority of skin cancers are non-melanoma skin cancers, which account for about 40 percent of all new cases of cancer occurring each year in the United States. The incidence of this cancer has been increasing for several decades.[1] Most of these are basal cell cancer and squamous cell cancer of the skin which usually are quite slow growing and, if detected and treated, usually cured.

Malignant melanoma of the skin is the seventh most frequent cancer in both men and women, and the incidence of this cancer is increasing at about four percent per year in the US.[2] About 34,000 new cases of malignant melanoma of the skin are diagnosed each year. Again, if detected early and treated, malignant melanoma is usually curable. Although the five-year survival is 85 percent, 7,200 people die of malignant melanoma in the US every year.

Ultraviolet light

Almost all nonmelanoma skin cancers and malignant melanomas are due to damage to skin cells by the ultraviolet (UV) part of the sunlight spectrum. Although this has been known for many years, the recent finding that mutations in genetic DNA caused by UV light are found in squamous cell cancers, in premalignant lesions, and in sun-damaged skin confirms the relation between sun exposure and skin cancer at the molecular level.[3]

Even before this molecular evidence became available, there was little doubt that sunlight was the cause of most skin cancers. Skin cancer rates are about twice as high in the southern states than in the northern states, and, in Caucasian populations around the world, the rates increase with proximity to the equator, where the intensity of sunlight is strongest. Nonmelanoma skin cancer is more common in outdoor workers, particularly in hotter areas, and among people with sun-damaged skin.[4] Almost all nonmelanoma skin cancers occur in sun-exposed areas of the skin, particularly the face, scalp, and neck, and the forearms and back of the hands.[5]

Skin cancer provides a classic example of the way in which an environmental exposure, such as sunlight, can interact with inherited characteristics. Rates of skin cancer are more than 10 times higher in Whites than Blacks, due to the fact that melanin, the dark pigment in skin, absorbs UV rays before they damage DNA. Among Whites, rates are about three times higher among people with red hair than among people with black hair, with rates among blonds being intermediate. For a given amount of sunlight exposure, people who burn easily are at higher risk than people who tend to tan rather than burn.[6] This has led to the common belief that developing a tan actually may protect against skin cancer. It is probable, however, that while developing a tan may protect against acute sunburn, the exposure to UV radiation that this entails still leads to damage of cellular DNA and increases skin cancer risk. The best strategy to reduce risk is to avoid unnecessary and excessive exposure to sunlight. The relationship of sun exposure to malignant melanoma may be subtly different. Malignant melanomas do not always occur in the most sun-exposed areas of the skin and are not so strongly associated with outdoor occupations.[7] Rates are still highest in Whites, particularly those living in areas with high-intensity sunlight.[8] It has been suggested that the major risk factor for malignant melanoma may be the number and frequency of sunburns, rather than total accumulative exposure to sunlight; however, this is still controversial. The major message for cancer prevention is the same: Avoid unnecessary and excessive exposure to sunlight.

While it is never too late to reduce sun exposure, for many people, more than half of their lifetime exposure to sunlight may take place during childhood and adolescence – when there may be more leisure time to play outdoor sports and sunbathe. As with many cancers, exposure to the carcinogen may not result in cancer for several decades, again underscoring the importance of avoiding exposure in early life, when there is a maximum time for the results of the damage to cause harm.[9] Similar to cigarette smoking, however, this is a time of life in which peer pressure to engage in dangerous behaviors – in this case the pursuit of a tan – may be at its greatest. Thus, it is important that adults protect their children from excessive sun exposure and try to educate them in appropriate protective habits.

Sunlight is necessary for survival, particularly as vitamin D is formed in the skin due to sunlight exposure.

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For most people, exposure to the sun is important as a mood elevator and, for many, the feeling of the sun's warmth is pleasurable. What, then, are sensible sun exposure habits? Most people can still enjoy the outdoors, even in sunny climates, while wearing a brimmed hat to protect the face and neck, and long-sleeved shirts to protect the forearms. Exposed skin can be protected with sunscreen with a skin protection factor (SPF) higher than 15. It recently has been demonstrated that sunscreens protect against the incidence of premalignant skin conditions.[10] If one must be in the sun, then avoidance of the peak intensity hours of 10 am to 3 pm will reduce UV exposure.

The major DNA-damaging spectrum is UV-B rays. It has been speculated that UV-A rays used in sunlamps and sun beds may not cause skin cancer. Recent laboratory evidence,[11] however, demonstrates that sunlamps and sun beds do cause DNA damage, and it is highly likely that excessive exposure also causes skin cancers. Thus, exposure to these artificial UV light sources should be avoided altogether.

Conclusions

Almost all skin cancers are curable if detected and treated before they invade through the bottom layers of the skin and spread to other tissues. Monthly self-examination of the skin and prompt report of skin lesions that have grown or changed to a physician, would save many lives. Changes in the size, color, or regularity of a mole are particularly important to have evaluated quickly. The five-year survival for malignant melanoma when it has not already invaded through the bottom layers of the skin is greater than 90 percent. Once the tumor has spread to distant organs, the five-year survival is less than 20 percent.

Proportion of major cancers due to sunlight

Melanoma	– over 90 percent
Basal cell carcinoma	– over 90 percent
Squamous cell carcinoma	– over 90 percent

Suggestions

- Avoid unnecessary and prolonged sun exposure.
- Use a sunscreen with a skin protection factor higher than 15.
- Avoid exposure to sun between the hours of 10 am and 3 pm.
- Wear long-sleeved outdoor clothing and a hat with a brim in the sun.
- Protect your children from excess exposure to sunlight.
- Don't ignore any suspicious skin growth, particularly one that changes in shape, color, or pigmentation.

Suggested Further Reading

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