Nonmelanoma Skin Cancer in the Asian Population of Kauai, Hawaii

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Nonmelanoma skin cancer (NMSC) is reported to be most common among white individuals; however, in the Asian population NMSC has been poorly studied. In fact, the incidence of nonmelanoma in the Asian population is likely underreported. Even though Asians worldwide reportedly have a lower incidence of NMSC than the white population, rates have continued to rise in this ethnic group, particularly among those living in Kauai, Hawaii.[1] This article reviews various studies on the incidence of NMSC in Asian Kauaians and the importance for preventive measures in this group. Emphasis is placed on the importance of regular self-examination and professional examination of the skin, public education on detection and prevention, and the need for screening programs.

Although the reported incidence rates of NMSC among Asians are not as high as those noted in white individuals, NMSC still poses a significant risk in this population, especially among Asian Kuaians.[1] Many believe that Asians have an inherent protection against UV radiation because of their darker skin pigmentation; however, there are a variety of factors that contribute to the development of NMSC in this population that may differ from the white population.[2] The exact incidence of NMSC in Asians is difficult to estimate because resources are sparse in different parts of Asia, particularly in third world countries and less developed regions, and many do not have reporting systems in place such as a tumor registry.[2] The highest reported incidence of NMSC in the Asian population is in Kauai, Hawaii.[1] In fact, the general population of Kauai has the highest incidence of NMSC in the United States.[1]

Additionally, the incidence of NMSC is surprisingly high among Japanese Kauaians. The incidence of NMSC among Japanese Kuaians differs significantly from Japanese people who reside in Japan. The underlying reasons for this differentiation appear to be multifactoral in nature.[1] In Asians, NMSC has not been fully appreciated because of the perception that the naturally darker skin of Asians inherently provides a significant amount of UV protection as compared with white skin. Nevertheless, when NMSC is diagnosed in the Asian population, there is potential for greater morbidity if the time to diagnosis has been delayed due to lack of suspicion.[1] Therefore, it is important to be familiarized with the various factors that contribute to the development of NMSC in the Asian population in order to promote early detection and intervention.

Background of Kauai

Kauai is the oldest and most western Hawaiian island with a resident distribution composed of white individuals (11,043), Japanese (9663), Filipinos (10,111), and Polynesians (5670).[1] With a permanent population of about 40,000, Kauai has a yearly UV exposure dose of approximately 21 10^3 J/cm^2 and is located at the latitude of 22°N.[3] Kauai is separated from other islands by 80 miles of open ocean and, in the past, most medical care was delivered locally by a small group of physicians.[1] In recent years, there has been only one laboratory to process histologic tissue in Kauai.[1] This gave researchers the advantage of a single evaluation site, but also the disadvantage of limited resources.

The climate of Kauai is warm year round, requiring only minimal clothing with limited skin coverage that is culturally acceptable during outdoor activities.[4] Many studies have suggested intense UV radiation as the main culprit for high rates of NMSC in Kauai.[3] Kauaians have a high incidence of basal cell carcinoma (BCC) in their general population because of their lifestyle, which includes various outdoor leisure activities and outdoor occupations.[5-7] It has been suggested that BCC in the general population of Kauai is mainly due to intense UV irradiation occurring in sun-exposed areas.[3] However, UV radiation does not appear to be a universally important

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etiologic factor in squamous cell carcinoma (SCC), which tends to also occur on non–sun-exposed body sites in Kauaians.[2] Many authorities believe that the intense year-round UV radiation exposure, which occurs in Kauai, induces greater actinic damage, thereby increasing the risk for NMSC.[3]

Epidemiology

In addition to being very common, NMSC is now estimated to occur at a rate equal to all other malignancies combined in the United States,[8] with NMSC representing at least 20% to 30% of all neoplasms in white individuals, 2% to 4% of all neoplasms in Asians, and 1% to 2% of all neoplasms in blacks and Asian Indians.[2] The majority of NMSCs are BCC and SCC, with an overall ratio of 4:1 of BCC:SCC.[8] Medicare claims data suggest that although the unit cost of treatment for NMSC is significantly less than treatment for many other forms of cancer, the large volume of cases of BCC and SCC make NMSC the fifth most costly cancer, accounting for 4.5% of all Medicare cancer costs.[9] Incidence rates vary significantly depending on geographic location and ethnicity of the study population.[8] Generally thought to be a result of increased cumulative UV exposure, most studies support that incidence rates of NMSC are increasing significantly worldwide.[8] This is in large part due to the unavoidable increase in the elderly population with the contribution of increased outdoor activity, depletion of the atmospheric ozone layer, environmental pollutants, gene mutations caused by UV damage, and possibly improved methods of reporting data.[8]

Characteristics of NMSC Reported in Kauai

Many cases of NMSC in Kauaians develop on the back and distal aspect of the upper extremities, thus correlating with the limited clothing style of outside field workers in Kauai.[10] It has been reported that BCC on the back represents 21% of tumors in Kauai versus 5% of tumors noted in Rochester, Minnesota.[1] On the contrary, 8% of BCCs in Kauai involved the nose as compared with 22% in the Rochester population.[1] Incidence rates of BCC are 30 per 100,000 Japanese Kauai residents, with an average patient age of 75 years. More than 80% of these BCCs involve the head, neck, and upper extremities.[1] In contrast, the average age for development of BCC is 30 years in white Kauaians.[5] A 39-year-old white Kauaian male with BCC involving the upper cutaneous lip is depicted in the Figure.

In general, white individuals who live their entire lives in Kauai exhibit a 50% chance of developing a BCC by the age of 82 years, and by age 76 years there is a 10% chance of developing SCC.[4,11] Incidence rates for BCC, SCC, and SCC in situ in the Japanese population in Kauai are 12, 4, and 11 times lower, respectively, than in white Kauaians, suggesting that Asian skin may exhibit some partial and inherent protection against UV radiation.[12-14]

There are also differences noted in rates of NMSC between genders in Kauai. In a study spanning 1983 through 1987, the incidence of BCC in Kauai was evaluated. It was suggested based on the results of this study that men had an overall higher risk for BCC than women.[1] However, there was a reversal of this trend in the group ranging in age from 25 to 34 years with a female to male ratio of 1.0:0.9. This may be due to an increase in outdoor activity, especially among younger women because of sunbathing and clothing preferences.

In contrast to BCC occurring in Kauai, SCC is relatively uncommon in both the white and Japanese populations in Kauai before the age of 50 years.[10] This suggests that Japanese Kauaians exhibit a pronounced latent period for development of BCC that is not observed with development of SCC when compared to white Kauaians.[1,5,10] Reported rates for cutaneous SCC are approximately 23 per 100,000 Japanese Kauaian residents, with an average patient age of 80 years. The head and neck regions are the most commonly affected body sites.[1]

Japanese Kauaians Versus Japanese Who Live in Japan

The incidence rates of NMSC, BCC, SCC, and SCC in situ are at least 45 times higher in the Japanese residents of Kauai than the Japanese population living in Japan, perhaps due to Kauai's more intense year round UV radiation, outdoor activity, and exposure to certain pesticides.[15] Kauai is much lower in latitude than Japan.[10] Asians in Kauai receive twice the dose of UVB radiation causing a

A basal cell carcinoma of the right upper cutaneous lip in a 39-year-old white Kauaian male.

3- to 4-fold higher incidence of precancerous lesions than compared to Le Island (25° 10`N), Japan.[16] A review of prospective studies performed in 1983 to 1985 noted that NMSC was found in 123 per 100,000 Japanese Kauaians versus 1.2 to 5.4 per 100,000 Japanese in Japan.[10] Surveys done in the years 1987 to 1996, suggest that BCC is the most common skin cancer in Japan, accounting for 47% of all cutaneous malignancies.[17] In Japan, the incidence of BCC increased between 1976 to 1980 and 1986 to 1990, whereas SCC incidence rates remained constant.[18] The crude and age-specific rates of NMSC of Japanese Kauaians are much higher than those in Japan.[10] Differing rates are attributed to the fact that many of the Japanese Kauaians work in fields and plantations where they are exposed to pesticides that are speculated to be carcinogenic.[10] Kauaian women are equally likely to be as affected with NMSC as men due to the fact that many Kauaian women tend to work outside in the fields.[10]

During the years 1983 to 1987, the incidence of NMSC (BCC, SCC, and SCC in situ) was at least 45 times higher in the Japanese population in Kauai than in Japan.[12] It has been observed that the incidence rate of NMSC in both Japanese and white individuals increases with age.[12] In the Japan and Kauai surveys related to Japanese subjects, the BCC:SCC ratio was 1.1:1 and 1.3:1, respectively.[19,20] In contrast, the white Kauaians demonstrated an estimated ratio of 4:1 for BCC:SCC.[1,4] The calculated incidence of NMSC among the Japanese in Hawaii is approximately 40 times less than that of white individuals who live in the same geographic area, which appears to indicate some inherent protection against UV radiation afforded by Asian skin.[21] However, this should not be interpreted to mean that Asians do not develop NMSC.

Risk Factors for Development of NMSC

Latitude exposure to the sun is thought to be the most important risk factor for NMSC in Asians.[1,21] However, other factors, such as working outdoors, having Fitzpatrick skin types I or II, or a history of severe sunburns during childhood, were also found to be important risk factors.[21] In addition, tanning bed exposure, history of radiation therapy, albinism, scars, chronic ulcers, chronic infections, nevus sebaceus, immuosupression, trauma, and arsenic ingestion were also identified as risk factors.[2] The inviting warm weather climate and geographic location of Kauai, occupational exposure (especially in outdoor workers), and cultural practices with minimal clothing are some reasons why Kauaians demonstrated a high relative incidence of truncal NMSC.[12] Many Asian Kauaians work as farmhands and are routinely exposed to pesticides like Paris Green, an inorganic arsenic commonly used in house paint.[10] Other factors, such as smoking, have also been shown to be an independent risk factor for developing SCC, with a relative risk of twice that of control subjects.[22] Reports of SCC arising in scars located in sun-exposed areas in elderly Kauaian patients suggest a synergistic effect with trauma and UV radiation.[2] Another factor that may potentially contribute to the growing number of NMSC in Kauai is the depletion of the ozone layer by chlorofluorocarbons and subsequent increase in solar UV radiation.[23] It has been suggested that a 1% reduction in the ozone layer leads to a 1% to 3% increase in skin cancer.[4]

Inherent Protection Factors Related to Skin Type

Darker skinned individuals have increased melanoctye activity and larger, more dispersed melanosomes in contrast to white individuals.[2] Certain types of skin cancers are dependent on the degree of melanin pigmentation and intrinsic factors such as DNA repair, along with climate, geography, occupation, and recreational activities.[21] It is believed that darkly pigmented skin evolved toward the equator to protect against UV light.[24] Increased epidermal melanin can provide inherent sun protection factors of up to 13.4 in blacks and darker pigmented individuals.[2] Black epidermis has been reported to transmit 17.5% of UVA and 7.4% of UVB as compared with 55% and 24% in white individuals, respectively.[25-27] Dark skin transmits less UV light because larger, more melanized melanosomes in the epidermis of dark skin absorb and scatter more light energy than the smaller less melanized melanosomes of white skin.[2] The dose of UV radiation required to produce a minimally perceptible erythema is estimated to range from 6 to 33 times greater in darker pigmented individuals versus white individuals.[27] Factors such as UV exposure, latitude, and skin pigmentation all contribute to the development of NMSC in Asians.[2] UV exposure seems to be the most significant factor affecting NMSC in Asians.[2] An analysis of Singapore cancer registry data from 1968 to 1977 revealed that fair skinned Chinese had a 2-fold greater incidence of skin cancer than darker skinned Malays or Asian Indians.[28] The Asians with the highest incidence of NMSC were those that had Fitzpatrick skin types I and II, whereas those with more darkly pigmented skin had a significantly less incidence of NMSC.[2] In addition, biologic, genetic, and cultural practices may impact differences in the propensity for development of NMSC in Asians.[29]

Morphology and Location of NMSC in Asians

The morphology and clinical features of NMSC in Asians share similar characteristics to both dark skinned ethnic

groups and white individuals combined.[2] A retrospective study of 234 Japanese with BCC showed that 75% of the tumors exhibited a brown to glossy black pigmentation.[13] The histopathologic features of BCC in the Japanese population are comparable with those of other ethnicities.[15] The most commonly reported histopathologic type of BCC is the solid or nodular type, however there appears to be a higher incidence of the adenoid type in Asians.[15] Pigmented NMSC can also present with nonspecific scaling, hyperkeratosis, and velvety or verrucous surface texture characteristics.[25,30]

Cutaneous SCC affecting individuals with darker skin types commonly develops at anatomic sites that are regularly sun exposed, especially on the lower extremities.[2,25,30] SCCs that develop within a chronic scarring process in skin, which has been reported in blacks, exhibit a 20% to 40% risk for metastasis as compared with the 1% to 4% metastatic rate associated with SCCs involving sun-exposed skin in white individuals.[31,32] This differentiation in metastatic rate may be due to several factors, such as delay in detection and a low index of clinical suspicion of NMSC in an individual presenting with a darker skin type.

Conclusion

The demographics of the United States population are constantly changing, with a progressive increase in minority populations. It is estimated that by the year 2050, Hispanics, Asians, and blacks will represent 50% of the population in the United States.[33] Therefore, it is important to understand dermatologic aspects of pigmented skin and for health providers to be familiarized with the cultural habits and practices of various races. The studies in Kauai have demonstrated that NMSC among Asians is not uncommon. Furthermore, the statistical generation of data on NMSC involving Asians living in all regions of the United States is sparse and would be a topic of interest for future research. It would also be interesting to compare this data from Asian Kauaians and other Asian populations, such as Chinese, Japanese, Koreans, Fillipinos, Thais, Vietnamese, Malays, Indonesians. In conclusion, there is a great need for future studies in the Asian population and a need for increased surveillance to identify any unrecognized risk factors involved in the pathogenesis of NMSC in this growing number of individuals in the United States.

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