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BCC and Childhood Low Dose Radiation

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ABSTRACT

Skin cancer is a late complication of ionizing radiation. Two skin neoplasms prominent Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (SCC) are the most famous complications of radiotherapy. Basal Cell Carcinoma (BCC) is the most common human malignant neoplasm. Many genetic and environmental factors are involved in its onset. BCC is observed in sun-exposed areas of skin. Some patients with scalp BCC have had a history of scalp radiation for the treatment of tinea capitis in childhood. Evidence that ionizing radiation is carcinogenic first came from past reports of nonmelanoma skin cancers on the hands of workers using radiation devices. The total dose of radiation and irradiated site exposed to sunlight can lead to a short incubation period. It is not clear whether BCC in these cases has a more aggressive nature and requires a more aggressive resection of the lesion. The aim of this review was to evaluate the differences between BCC specification and treatment results between irradiated and nonirradiated patients.

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Introduction

Basal Cell Carcinoma (BCC) is the most common human malignancy (1). BCC develops predominantly in men in their 50s, 60s and 70s. But in recent years, incidence of BCC has also increased in women. Many genetic and environmental factors are involved in its onset BCC is observed in sun-exposed areas of skin (2). The head and neck are the most common sites accounting for about (85%) of cases. There are many patients with BCC of the scalp who had a history of childhood radiation to the scalp for treatment of tinea capitis. Radiotherapy of the scalp is a well-known risk factor for BCC, but it is not known whether these BCCs have a more aggressive nature and require a more aggressive modality of treatment (2).

Radiation exposure to the scalp during childhood for tinea capitis was associated with a fourfold increase in skin cancer, primarily basal cell carcinomas, and a threefold increase in benign skin tumors (3-4). They also have more lesions than nonradiated patients (5).

The number of recurrent lesions are significantly higher in non irradiated patients (2).

Discussion

Various studies demonstrated data about the role of childhood low dose radiation in scalp BCC.

Karagas suggests that exposure to therapeutic radiation is associated with BCC but not with SCC.

These kinds of neoplasms usually occur after radiation therapy for treatment of tinea capitis (6).

Ron found a linear decrease in the relative risk of head and neck skin cancer with increasing age at radiation for tinea capitis, and in this study, treatment occurred solely during childhood (3).

Shore's study showed a relative risk of (3.6) (95% confidence interval, 2.3-5.9) for head and neck BCC among irradiated Caucasians in response to a dose of about 4.8Gy to the scalp. Children irradiated at young ages had the highest risk for BCC. He also mentioned that exposure in low ages to Ultra Violet (UV) radiation increases the relative risk of BCC. Shore also reported several different cancers in irradiated patients.

(40%) of his irradiated cases have had multiple BCCs (7). In Mseddi's study the majority of cases were men, which may be due to higher prevalence of tinea in leading to higher radiation therapy in men.

Moreover, job and sunlight exposure are also important risk factors. In Mseddi's study, about (40%) of BCCs occurred on the occipital area and (65%) were in the scalp site. The number of lesions varied from one to five and the size from two to 45 mm. The average number of lesions was (1.76) per patient. The average patients' age at the time of radiation was five to 17 years in Mseddi's study respectively (8).

In Maalej's study, patients' age at diagnosis of

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malignancy ranged from 20 to 83 years with an average of 47 years. In about 61 patients (62%), the scalp appeared normal, and in (38%), radio dermatitis was noted. BCCs were the most frequent tumors arising on chronic radio dermatitis. The radiogenic BCCs tend to be multiple and manifest as conventional superficial BCC, nodular BCC, and rarely, fibroepithelioma Pinkus and keloidal types. Linear BCC rarely develops in the irradiated areas. In this study the average number of lesions was (1.5) per patient, and the average patients' age at the time of irradiation was 12 ± 6 years (5). In one of the studies in Iran by Hassanpour, no significant difference in gender and age was observed between the radiated and irradiated children (2).

The radiated group had a longer history of scalp lesions. They also had more hospital admissions and surgeries, with a longer period of hospitalization.

Mean number of primary lesions, the location of the tumor, and the depth of invasion did not differ significantly between the radiated and irradiated children. There was no meaningful difference in safe resection margin for the first lesion between the radiated and irradiated children; however, the number of recurrent lesions was significantly higher in the radiated group. Also, need for more aggressive resection and more complicated reconstruction was more in the radiated group (2).

In Meibodi's study on clinicopathological evaluation of radiation induced BCC, 60 men and 20 women were included, the majority of whom were in their 60s decade of age. Plaque was the most common clinical pattern of BCC. (51%) of the patients had pigmented and (42.5%) had multiple lesions. The scalp was the most common site of involvement. Histologically, macronodular and pigmented carcinoma were the most predominant forms of BCC (9).

Tessone's study was about Radiotherapy-induced basal cell carcinomas of the scalp (10).

Tissue samples of excised scalp BCCs from seven previously irradiated patients and seven not previously irradiated patients were frozen upon excision and genetically analyzed using Deoxyribonucleic acid (DNA) microarray chips.

No correlation was found between previous irradiation and gene expression (10). In one of the studies in Portuguese by Labareda ten out of 29 admitted patients have been treated by X-ray epilation for tinea capitis in childhood, and four had taken arsenic containing medicines. Four lesions recurred but the follow-up was below five years in most cases.

Labareda’s study confirms the impression of a more aggressive behavior for basal cell carcinomas (11).

Frentz studied nonmelanoma skin cancer of the scalp. Characteristically, scalp cancers associated with previous grenz-ray treatment were basal cell carcinomas, the male/female ratio was less than (0.1) and two-thirds occurred in patients with multiple skin cancers. That grenz ray-related scalp cancers more often develop in females than in males was confirmed by comparison to the sex distribution among patients treated on the scalp with grenz rays (12).

A retrospective study by Zaraa done on 31 cases of Coetaneous carcinoma induced by radiotherapy including 47 BCCs and two SCCs, shows that radio-induced coetaneous carcinomas are dominated by basal cell carcinoma. They arise approximately ten years earlier than carcinoma in patients with no history of scalp irradiation. However, X-ray exposure does not seem to influence clinical or histological presentation, therapeutic modalities or prognosis of these kinds of tumors. The prognosis of radio-induced coetaneous carcinomas was similar to that of other coetaneous carcinomas with the same histological type and equivalent degree of invasion (13).

A case report by Ekmekci showed that on multiple basal cell carcinomas developed after radiation therapy for tinea capitis. They report a patient who had received low-dose radiation for the treatment of tinea capitis and developed multiple BCC in the radiated areas after a long latent period of 53 years (14).

In another study of Mseddi on the profile of basal cell carcinomas of the scalp after radiotherapy for tinea capitis' 51 men and 12 women, a total of 108 BCCs of the scalp, were reported (1.76 lesions per patient and an average (1.13) cm on diameter). The mean age at the occurrence of BCC was (45.5) years.

Thirty (7%) of BCC occurred on the occipital area; (28.7%) were in the parietal site. The most frequent clinical aspect was the nodular BCC (51%) and cicatricial basal cell carcinoma (35%). Histological study showed a nodular aspect in (74 %) of cases and pigmentation in (62%). It is concluded that BCC of the scalp following X-ray therapy for tinea capitis has some histological and clinical particularities.

It represents the most frequent neoplasms developing on irradiated scalp (15).

Conclusion

Scalp BCC in patients with a history of childhood radiation therapy must be considered as a malignancy with a high invasive nature (like other BCCs), but BCCs in these patients behave more aggressively.

This does not mean that they are necessarily more invasive in clinical examination or even in histopathologic studies. Moreover, it is very important to be alert about patients who referring to their physician for any suspicious lesions.

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