Radiation-induced basal cell carcinoma

Omid Zargari

1 Consultant dermatologist, Rasht, Iran

Key words: basal cell carcinoma, radiotherapy, tinea capitis, Iran, Rasht


Received: December 8, 2014; Accepted: January 26, 2015; Published: April 30, 2015

Copyright: ©2015 Zargari. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: None.

Competing interests: The authors have no conflicts of interest to disclose.

All authors have contributed significantly to this publication.

Corresponding author: Omid Zargari, MD, FAAD, 15, Ave.103, Golsar, Rasht 41378, Iran. Tel. +98 13 33117520; Fax. +98 13 33123438.
E-mail: ozargari@gmail.com

Background: The treatment of tinea capitis using radiotherapy was introduced at the beginning of the twentieth century. A variety of cancers including basal cell carcinoma (BCC) are seen years after this treatment.

Objective: We sought to determine the clinical characteristics of BCCs among irradiated patients.

Methods: The clinical records of all patients with BCC in a clinic in north of Iran were reviewed.

Results: Of the 58 cases of BCC, 29 had positive history for radiotherapy in their childhood. Multiple BCCs were seen in 79.3% and 10.3% of patients with history and without history of radiotherapy, respectively.

Conclusions: X-ray radiation is still a major etiologic factor in developing BCC in northern Iran. Patients with positive history for radiotherapy have higher rate of recurrence.

Introduction

“Primum no nocere!”—Hippocrates

Tinea capitis was a common disease in northern Iran, where the majority of population still resides in rural areas. The first effective antifungal agent, i.e., Griseofulvin, was introduced in 1959. Up that time, there was no therapy available for patients with tinea capitis except radiation therapy (RT).

It has been estimated that approximately 200,000 children worldwide received RT for tinea capitis [1]. There is no clear data on the number and method patients were treated in Iran, but regarding the poor hygienic status of people, it can be imagined that probably thousands of patients, mostly children, have been treated with radiotherapy. Unfortunately, many did not even have this privilege and were left untreated or had underwent non-efficient remedies. Here, I will take a historical look at the issue followed by analyzing the clinical characteristics of BCCs in irradiated patients.

Materials and methods

In a retrospective study, the clinical records of all patients with BCC were reviewed. Demographic details as well as clinical details and history of RT for treating tinea capitis was analyzed. Data were analyzed using SPSS and P-values less than 0.05 were considered significant.
Guilan is a province located in northern Iran, nowadays with a population of around three million. Guilan, with its humid climate and heavy rainfalls, is the center of rice and tea farms in Iran. During the early years of twentieth century, this province and its capital, Rasht, were the battlefield of civil wars and invasions by Russians and the British. At that time, diseases such as malnutrition, cholera, tuberculosis, malaria, typhoid, leprosy and skin infections were common in this region.

The American Presbyterian mission started its mission in Guilan in 1905, and the American Christian Hospital that was founded by this group was among the first hospitals made in Northern Iran circa 1917 and maybe the first hospital with X-ray facility (Figure 1). The major figure in this hospital was Dr. John Davidson Frame (1880-1942) who established the hospital and worked as a physician and surgeon in Rasht for about 37 years (Figure 2) [4,5].

The exact number of patients with tinea capitis who have been treated with radiotherapy in the American Christian Hospital and other centers in Guilan is unknown, but we as dermatologists are still seeing signs of radiotherapy-induced tumors today. Also, the dosage of RT was not clear, but the target dose was the induction of total depilation.

The cutaneous symptoms after radiation exposure are based on a combination of inflammatory processes and alteration of cellular proliferation as a result of a specific pattern of

<table>
<thead>
<tr>
<th>TABLE 1. Demographic and clinical characteristics of patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, no (%)</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Age (mean)</td>
</tr>
<tr>
<td>Number of lesions</td>
</tr>
<tr>
<td>Solitary, no (%)</td>
</tr>
<tr>
<td>Multiple, no (%)</td>
</tr>
</tbody>
</table>

RT: Radiotherapy.

versity Hospital, they found a relative risk (RR) of 3.6 for developing BCC in irradiated children [7], in 40% of whom the BCCs were multiple. Also, they found an inverse association between BCC risk and age of radiation exposure [7]. In another study, Ron et al compared 10,834 patients irradiated for tinea capitis in their childhood in Israel to a control group of 16,226, demonstrating an RR of 4.9 (95% CI = 2.6–8.9) for BCC in the irradiated group [8].

The predominant type of BCC in our study was nodular type, which was in concordance with the study done in Tunis [9].

BCCs have been stratified as low-risk or high-risk according to their propensity for recurrence [10]. Our study revealed a greater risk for recurrence among those who have had history for radiation. Hassanpour et al compared the management and treatment characteristics of patients previously irradiated for tinea capitis as well as unexposed patients and found that the previously irradiated patients proved to be more difficult to treat, with more hospital admissions (P = 0.008), more operations (P = 0.01), and longer hospitalization period (P = 0.01) [11]. Risk factors considered include histologic subtype, horizontal diameter, anatomic location, and patient health status.

We believe that history of radiation should be considered as another independent risk factor for basal cell carcinoma in Iran. The reason for higher recurrence rate and more aggressive natural history of these tumors is as yet unexplained. A recent study has revealed that mitochondrial D-Loop instability is significantly higher in irradiated BCCs than in the non-irradiated ones [12]. On the other hand, a genetic study failed to demonstrate any genetic differences (specifically, difference in p53 and PTCH) between BCC in irradiated patients and BCC in non-irradiated patients [13]. Therefore, it seems that the natural history is more host-related than tumor-related. An interesting question is whether UV radiation and ionizing radiation have a synergistic effect.

This study is subject to several limitations. In addition to the problems inherent in any retrospective analysis, the sample size was small and lacking data on skin phototypes of patients and had no histopathologic comparison between the irradiated and non-irradiated patients.

Conclusions

This study shows that X-ray radiation for treating tinea capitis is a significant cause of BCC development in northern Iran. BCCs in those who had history of radiation have a more aggressive behavior with higher rate of recurrence.

References

5. Taeh H. The Hospitals of Rasht. Iran: Nashr-e farhang-e Ilia, 2005