CASE REPORT

Atypical fibroxanthoma of the scalp following hair transplantation in a 35-year-old male

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Received 12 February 2010; accepted 25 May 2010

KEYWORDS
Hair transplantation; Skin malignancy; Atypical fibroxanthoma (AFX); Laser CO2; Thermal injury; Chronic inflammation

Summary Atypical fibroxanthoma (AFX) is an uncommon spindle cell neoplasm of the elderly. This case report presents an atypical case of AFX of the scalp 8 years after hair transplantation in a 35-year-old male patient. Possible synergistic effects of previous sun exposure radiation to the scalp, together with the thermal and radiation injury of carbon dioxide (CO2) laser, might explain the mechanisms of the development of AFX at such an early age.

To the best of our knowledge, this case report is the first description in the medical literature of development of skin malignancy on a hair-transplanted scalp.

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Atypical fibroxanthoma (AFX), which was described in 1963 by Helwig, is an uncommon spindle cell neoplasm. AFX primarily affects elderly Caucasian patients who have severely sun-damaged skin of the head and neck or previously therapeutically irradiated skin. Histologically, AFX is a cutaneous sub-type of malignant fibrous histiocytoma. Most variants of malignant fibrous histiocytoma are aggressive, recur unless widely excised and have a significant metastatic rate. However, the cutaneous variant of AFX rarely disseminates and is considered to have a much better prognosis.

Clinically, AFX appears as a solitary, firm and painless erythematous nodule that is usually smaller than 2 cm. The lesion grows rapidly and may ulcerate, thus indicating its malignant nature. Its course is either indolent or locally aggressive and may recur after local excision. The reported recurrence rate is between 2% and 20%, often after incomplete excision. Regional metastasis appears in only about 1% of cases and is usually preceded by one or more locally recurrent tumours.

While AFX primarily affects the elderly in actinically damaged skin of the head and neck, young patients tend to develop AFX on the extremities and trunk. Historically, the treatment of AFX has consisted of complete, yet conservative, local excision. However, Mohs’ micrographic surgery has been recently advocated and found successful in reducing recurrence rate after primary excision.

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Case report

A 35-year-old healthy male underwent hair transplantation 8 years ago due to male pattern alopecia. Creation of the recipient sites for hair transplantation was carried out by CO2 laser.

Five months prior to his visit to our outpatient clinic, a deep reddish scaly nodule had appeared on his left anterior parietal scalp. No evidence of local trauma appeared, nor was any infection recalled by the patient. Physical examination revealed an elevated ulcerated nodule 2.5 cm long and 1 cm wide. The surrounding skin was dry and actinically damaged, with many scalds, and appeared to be atrophic (Figure 1, Top).

An incisional biopsy was performed, revealing non-conclusive findings.

Three weeks later, a wide excision was performed, followed by a partial-thickness skin graft applied to the soft tissue defect (Figure 1, Bottom).

The histopathological examination revealed an intra-dermal tumour composed of proliferating spindle cells with highly pleomorphic nuclei, occasionally bizarre mononucleate and multinucleate giant cells and atypical mitotic figures (Figure 2).

At the periphery of the tumour, fragmented elastic fibres, chronic inflammation and giant cell granulomas surrounding degenerated hair shafts were also noticed. A diagnosis of AFX was made. The tumour had been completely excised, with 1-cm free lateral borders, 0.4 cm from the deep margins.

No additional adjuvant therapy was advocated by the oncologist, apart from regular follow-up visits that included local inspection of the surgical site and cervical lymph node examination. The patient has refused our offer to reconstruct the scalp defect by employing tissue expansion followed by the advancement of an expanded hair-bearing flap. The patient is covering the skin-grafted area by elongating his hair and changing his hair style.

Discussion

Hair transplantation is a reliable and acceptable technique for hair restoration. Different techniques and instruments have been employed for recipient-site creation for hair transplantation. These include: cold metal (needles or Bard Parker blades), Er-YAG laser or high-energy CO2 laser. The laser removes tissue by vapourisation. It is not considered to compromise hair graft ‘take’ and has the advantages of surgical speed and haemostasis; yet it causes thermal injury to the recipient site. To date, none of these proposed techniques has been associated with subsequent skin malignancy.

AFX is considered to arise during the sixth to seventh decades of life. Using a comprehensive MEDLINE search, we reviewed selected cohort studies of AFX reporting the average age at presentation.1–8 It has been found that the age at presentation in 346 cases ranged between 67 and 81 years (average 71.2 years) (Table 1). The diagnosis of AFX in young individuals is uncommon and is considered to be of publishable value.9

In the presented case, the early age at which the tumour appeared on the scalp is unusual. While AFX primarily affects the elderly in actinically damaged skin of the head and neck, young patients tend to develop AFX on the extremities and trunk.1

The mechanisms by which hair transplantation is speculated to cause the development of AFX are radiation and thermal injuries.

Dei Tos et al.10 have found an ultraviolet (UV)-induced p53 mutation in AFX and have advocated that this finding provides the first objective evidence for the central role of UV radiation in the development of this tumour, as well as the first in vivo demonstration of solar UV-induced mutations in human mesenchymal neoplasm. In our case, the patient scalp skin showed clear evidence of actinic damage. UV light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays, in the range of 10–400 nm, with energies from 3 to 124 eV. In addition, UV laser diodes and UV solid-state lasers can be manufactured to emit light in the UV range. Wavelengths available include 262, 266, 349, 351, 355 and 375 nm. The CO2 laser produces radiant energy at a wavelength of 10,600 nm.

Furthermore, two reports of AFX developing at the scar site of a thermal burn11,12 indicate that thermal insult to the skin might serve as an initiator for AFX formation.
experimental evidence exists that substantiates the fact that heat has carcinogenic potential. In vitro studies have demonstrated that thermal cell damage is likely caused by the inactivation of essential enzymes, some of which are involved in DNA repair. Animal studies which have been conducted by Bain et al. have demonstrated that heat enhances UV-induced carcinogenesis in mice; that is, mice, which have been exposed to temperatures of 35–38 °C, had a shortened latent period for UV-induced tumours. Heat, through its ability to potentiate UV-induced DNA damage, may further augment sunlight radiation-induced carcinogenesis.

Therefore, recipient-site creation by thermal injury (caused by CO2 laser) in the process of hair transplantation is an additive factor that may have enhanced AFX development.

In the histological examination of our case, chronic inflammation and giant cell granuloma surrounding residual hair shafts that were present at the periphery of the Atypical Fibroxanthoma (H&E, original magnification ×20). Lower left: Chronic inflammation (left) and degenerated elastic fibers (right) were present in the dermis, adjacent to the tumor (not shown in this image) (H&E, original magnification ×20). Lower right: Giant cell granulomas and chronic inflammation are seen in the dermis adjacent to tumor (H&E, original magnification ×20).

<table>
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<th>Authors</th>
<th>Year</th>
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<td><strong>Total:</strong></td>
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<td><strong>346</strong></td>
<td><strong>71.2</strong></td>
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degenerated hair shafts (Figure 2) were found, which indicated an inflammatory irritation around the transplanted hair follicles. Following appropriate stimulation with tumour promoters, UV light, or various chemical agents, keratinocytes synthesise and secrete cytokines, which can mediate or participate in dermatotoxic responses such as inflammation, hyperkeratosis, hypersensitivity and skin cancer.17 Furthermore, Oberyszyn et al.18 have demonstrated that interleukin (IL)-1 alpha is a pivotal cytokine, which is produced by specific subpopulations of epidermal keratinocytes, and that IL-1 alpha primarily regulates the epidermal proliferation response, which results in hyperplasia.

In our presented case, the role of radiation as an irritant, which initiates the production of cytokines, which in turn, promote inflammation, might be associated with the development of the skin malignancy.

In conclusion, four possible cumulative factors could have triggered the early development of AFX in our patient: that is, sun exposure radiation, laser radiation, thermal insult and chronic inflammation. On the other hand, the development of AFX, in our case, could have been only a coincidence.

Conflict of interest

None.

Funding

None.

References