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CASE REPORT

Combined Corticosteroid and Minoxidil Therapy for Early Recovery in Radiation-Induced Alopecia: A Case Report

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Abstract: This case report describes a 42-year-old man who developed radiation-induced alopecia after an endovascular embolization procedure for a cerebral arteriovenous fistula. The alopecia appeared as a well-defined patch of hair loss on the right scalp, confirmed by biopsy showing lymphocytic infiltration and increased catagen and telogen follicles. The patient was treated with intramuscular corticosteroid injections and topical 5% minoxidil, leading to complete hair regrowth after three months. Radiation-induced alopecia, though rare and typically self-limiting, requires early diagnosis. This case highlights a novel therapeutic approach combining corticosteroids and minoxidil for faster recovery.

Keywords: radiation, alopecia, endovascular embolization, corticosteroid therapy, minoxidil

Introduction

Endovascular embolization is commonly selected as the primary treatment modality for arteriovenous fistulas and other cerebrovascular diseases, using fluoroscopy to visualize cerebrovascular lesions, followed by the embolization of the distorted vessel. However, prolonged exposure to high doses of radiation can damage the scalp skin and hair follicles. Radiation-induced alopecia represents one of the rare complications linked to these procedures. We present a typical case of radiation-induced alopecia after endovascular embolization and provide a literature review to summarize the current understanding and management strategies for this condition.

Case Report

A 42-year-old man presented to our dermatology department with a sudden patch of alopecia on the right half of his scalp, persisting for one week. Physical examination revealed approximately an alopecia patch with polygonal shape of rectangular-triangular concatenation on the right side of his scalp, involving 40% of the total scalp area (Figure 1A–C). Before the examination, the patient added that he underwent cerebral endovascular embolization treatment for a cerebral arteriovenous fistula in the quadrigeminal cistern three weeks prior (Figure 1D). Black dots, dystrophic hairs, and short vellus hairs were observed under trichoscope and no exclamation mark hair was found (Figure 2A). For further diagnosis, we conducted a scalp biopsy, and histopathology demonstrated sparse lymphocyte infiltration, with an increased proportion of catagen and telogen hair follicles (Figure 2B–F). The patient was finally diagnosed with radiation-induced alopecia after endovascular embolization. He underwent three monthly sessions of intramuscular compound betamethasone injection (1 mL per month), with topical treatment of 5% minoxidil tincture (1 mL per time, twice daily) combined with halometasone cream (appreciate amount, once daily). At the next month's follow-up, his hair had fully regrowth (Figure 3). The patient did not report any discomfort during the treatment, and no clinical relapse was observed during the 2-year follow-up.

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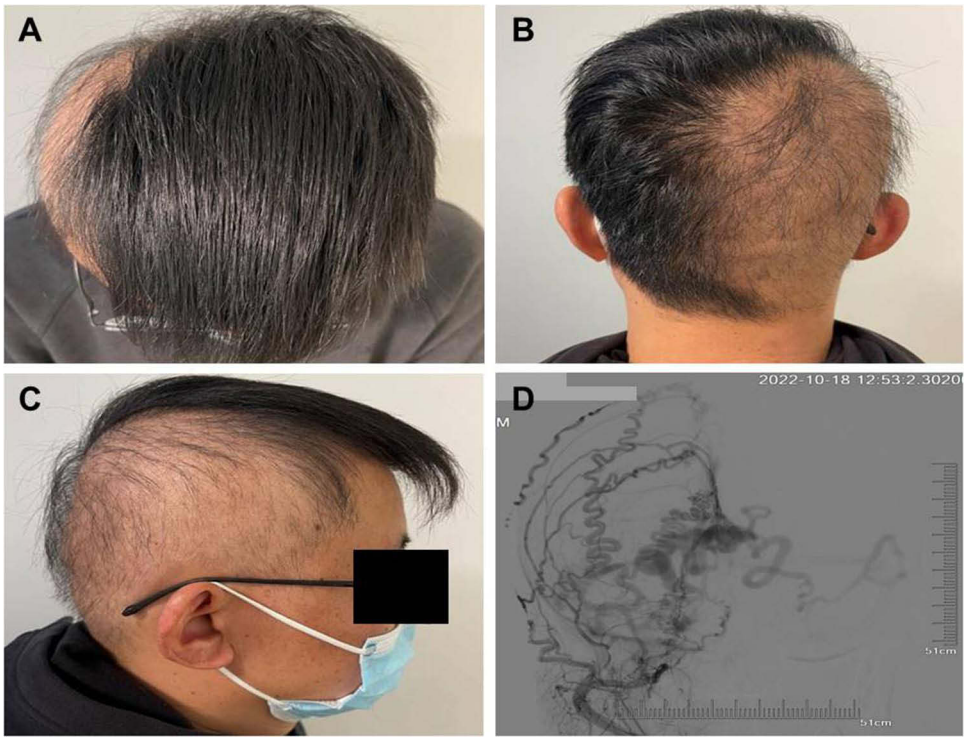

Figure 1 (**A**–**C**) Clinical images showing the hair loss affecting the right half of patient's scalp. (**D**) Fluoroscopic view of the cerebral arteriovenous fistula in the quadrigeminal cistern.

Discussion

Temporary alopecia is a relatively rare complication of acute radiation syndrome and is considered a specific form of radiodermatitis.[1] This occurs due to the heightened sensitivity of hair follicles to radiation exposure. Acute damage to actively dividing matrix cells of anagen follicles results in the loss of dystrophic hair. The late anagen hair prematurely transitions into catagen, followed by telogen, leading to premature hair shedding.[2] Radiation-induced alopecia typically manifests 2–5 weeks after the procedure and is influenced by various factors, including radiation dose, duration, interval between irradiations, area of irradiated surface, irradiation angle, and certain patient biological factors (such as age, smoking, malnutrition, tissue oxygenation, capillary density, genetics, and ethnicity).[3,4] A radiation dose of 3–6 gray results in temporary alopecia, while a dose exceeding 7 gray leads to permanent alopecia.[5]

Typically, radiation-induced alopecia presents with distinctive clinical features characterized by a well-defined round or rectangular alopecia patch with evenly reduced hair density. These features arise due to prolonged exposure from any single view during an endovascular embolization procedure. Trichoscopy revealed black dots, yellow dots, and dystrophic hairs, with exclamation mark hairs being rare. Histopathology showed an increased proportion of catagen and telogen hair follicles with or without inflammatory infiltration.[2,6,7] The main differential diagnoses could include alopecia areata, trichotillomania and pressure-induced alopecia. In our case, the patient underwent an initial digital subtraction angiography for detecting a cerebral arteriovenous fistula in the quadrigeminal cistern, followed by endovascular embolization treatment two days later. The total duration of these procedures was 172 minutes. The medical history can aid in making the correct diagnosis straightforward. Temporary hair loss typically regrew spontaneously within 2–6 months under observation. Treatment strategies reported in the literature mainly include topical corticosteroid and minoxidil lotion. In Lee's study, five patients presented alopecia after undergoing the procedure of intracranial aneurysm embolization. They all received treatment of superficial cryotherapy and 0.25% desoxymethasone lotion, and showed improvement after 4–5 weeks and completely recovered within 5–6 months.[8] In recent years, most patients diagnosed with radiation-induced alopecia after endovascular embolization received topical minoxidil, achieving complete hair regrew within 4–5 months follow-up.[1,2,9] Our case was the first to propose using systematic corticosteroid injections with

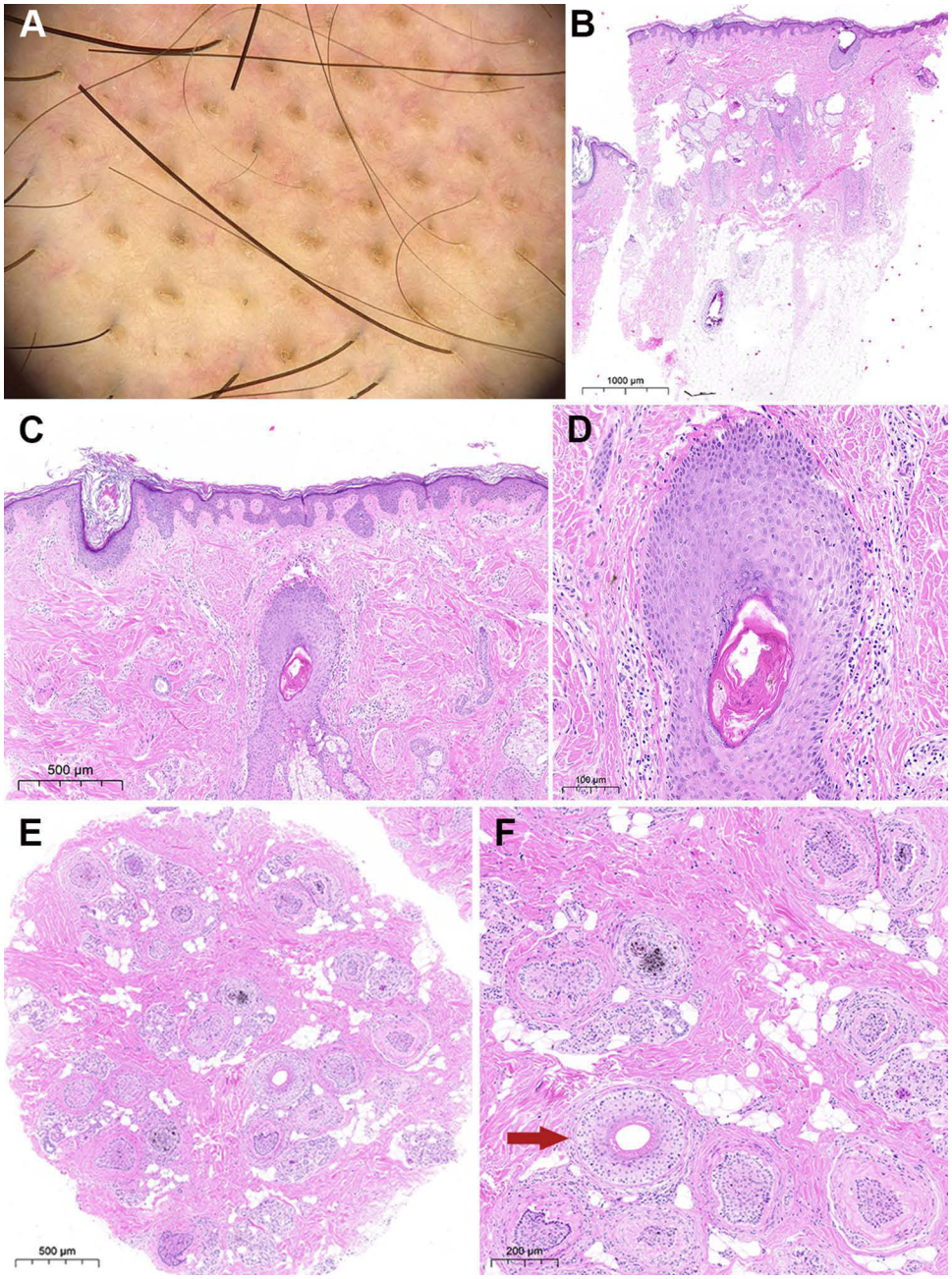

Figure 2 (**A**) Trichoscopy image showing numberous black dots, dystrophic hairs, and short vellus hairs without exclamation mark hairs. (**B**–**F**) Histopathology image (H&E staining) showing sparse lymphocyte infiltration around dermal blood vessels and hair follicles (vertical slides) and an increased proportion of catagen and telogen hair follicles (horizontal slide). Only one anagen hair follicle was identified in the horizontal section (red arrow), whereas other hair follicles were all in catagen/telogen phase.

topical 5% minoxidil to potentially improve outcomes. However, single case report with short follow-up was the limitation of the study.

Conclusion

Although radiation-induced alopecia is benign and self-limiting, dermatologists must promptly identify this condition and make an accurate diagnosis based on medical history and clinical features. This case presents the first successful treatment of radiation-induced alopecia after endovascular embolization using combined corticosteroid and minoxidil therapy, achieving complete hair regrowth significantly faster than single topical treatment or spontaneous recovery. Our

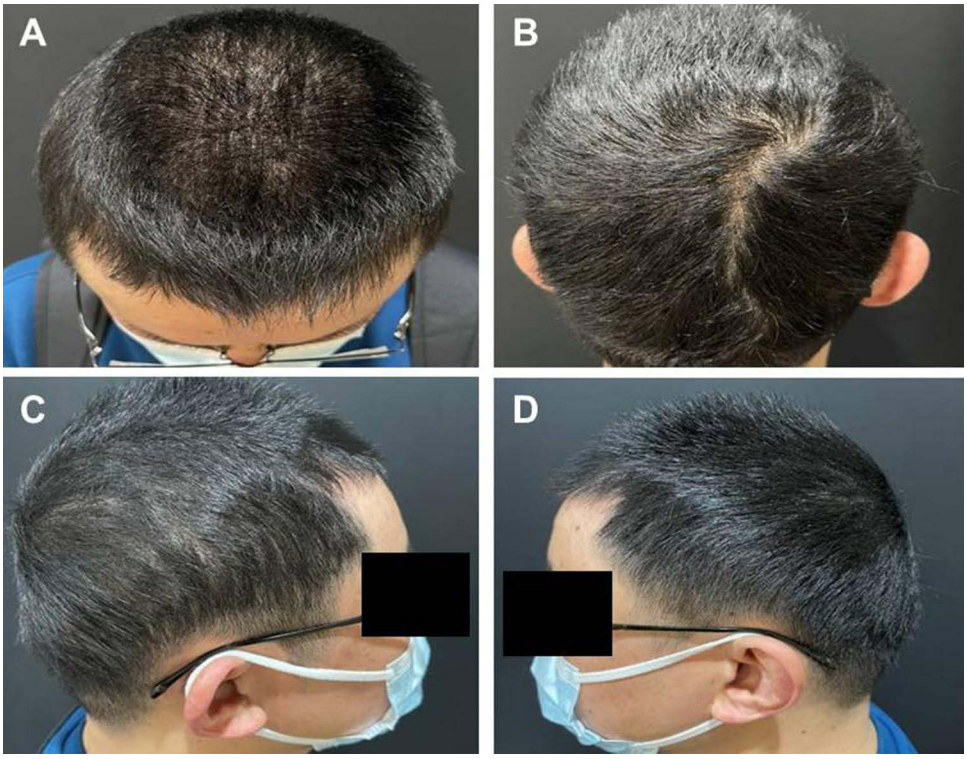

Figure 3 (**A**–**D**) Clinical images showing that the patient had complete hair regrowth after three-month treatment.

findings suggest that radiation-induced alopecia, and may offer clinicians alternative treatment strategies for this rare complication.

Patient Consent

A formal written consent was obtained for publication the case details and associated images from the patients. No institutional approval is required to publish the case details.

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Disclosure

The authors declare no conflicts of interest in this work.

References

1. Herrero-Moyano M, Hernández PM, Castañon PG, Monreal JLC. Transient rectangular alopecia after endovascular embolization: a case series of four patients describing dermoscopic and histopathologic findings. *Int J Trichol*. 2022;14(4):138–140. doi:10.4103/ijt.ijt_172_20
2. Ounsakul V, Iamsumang W, Suchonwanit P. Radiation-induced alopecia after endovascular embolization under fluoroscopy. *Case Rep Dermatol Med*. 2016;2016:8202469. doi:10.1155/2016/8202469
3. Podlipnik S, Giavedoni P, San-Román L, Ferrando J. Square alopecia: a new type of transient alopecia of the scalp following fluoroscopically endovascular embolization. *Int J Trichol*. 2013;5(4):201–203. doi:10.4103/0974-7753.130406
4. Kaushal A, Bindra A, Singh S, Sameera V. Single sitting of cerebral endovascular procedure causing alopecia. *Int J Trichol*. 2018;10(3):145–146. doi:10.4103/ijt.ijt_11_18
5. Nannapaneni R, Behari S, Mendelow D, Gholkar A. Temporary alopecia after subarachnoid haemorrhage. *J Clin Neurosci*. 2007;14(2):157–161. doi:10.1016/j.jocn.2005.12.031

6. Cho S, Choi MJ, Lee JS, Zheng Z, Kim DY. Dermoscopic findings in radiation-induced alopecia after angioembolization. *Dermatology*. 2014;229 (2):141–145. doi:10.1159/000362810
7. Bernárdez C, Alcaraz I, Molina-Ruiz AM, Requena L. Transitory rectangular alopecia after endovascular embolization: a case report and description of the histopathology findings. *Actas Dermosifiliogr*. 2015;106(10):848–850. doi:10.1016/j.ad.2015.06.006
8. Lee WS, Lee SW, Lee S, L JW. Postoperative alopecia in five patients after treatment of aneurysm rupture with a Guglielmi detachable coil: pressure alopecia, radiation induced, or both? *J Dermatol*. 2004;31(10):848–851. doi:10.1111/j.1346-8138.2004.tb00614.x
9. Lee H, Lee S, Lee YB, Lee WS. Radiation-induced rectangular alopecia after endovascular embolization of cerebral aneurysms: the necessity of a comprehensive study on its incidence and critical radiation doses. *Ann Dermatol*. 2019;31(Suppl):S24–S6. doi:10.5021/ad.2019.31.S.S24