SKIN

BRIEF ARTICLE

Antibody-Drug Conjugate Induced Hair Loss Responds to Minoxidil: A Case Report

Lily Kaufman, BS[1], Margaret Gatti-Mays, MD, MPH[2], Brittany Dulmage, MD[3]

[1] College of Medicine, The Ohio State University Wexner Medical Center, Columbus, Ohio, USA
[2] Division of Medical Oncology, Department of Internal Medicine, The Ohio State University Wexner Medical Center, Columbus, Ohio, USA
[3] Department of Dermatology, The Ohio State University Wexner Medical Center, Columbus Ohio, USA

ABSTRACT

Antibody-drug conjugates (ADCs) represent a novel class of targeted cancer therapies that commonly result in alopecia as an adverse effect. There is limited research regarding methods to prevent or treat alopecia for patients treated with ADCs. Minoxidil may be used to treat hair loss due to multiple etiologies, but is not conventionally recommended to patients actively undergoing cancer treatment. We present the case of a 64-year-old female with stage IV ER+/HER2 low-expressing breast cancer who experienced extensive treatment-induced alopecia after initiating fam-trastuzumab deruxtecan followed by sacituzumab govitecan who achieved significant hair regrowth with oral minoxidil while continuing ADC therapy. This case highlights the potential for oral minoxidil to facilitate hair regrowth during ADC therapy, suggesting that it may represent a valuable treatment for ADC-induced alopecia.

INTRODUCTION

Antibody-drug conjugates (ADCs) are targeted cancer therapies that combine the specificity of monoclonal antibodies (mAbs) with the potency of cytotoxic drugs.[1] ADCs have emerged as highly effective treatments for a variety of cancers, including multiple breast cancer subtypes.[2] Alopecia is a common adverse effect of ADCs, and research is limited regarding methods for preventing and treating alopecia among patients receiving these therapies.[3] We present a case of a patient who experienced treatment-induced hair loss that affected the entire scalp while on fam-trastuzumab deruxtecan, but notably, achieved significant hair regrowth with oral minoxidil while continuing ADC therapy.

CASE REPORT

A 64-year-old female with a past medical history of stage IV estrogen receptor-alpha (ER) positive/human epidermal growth factor receptor 2 (HER2) low-expressing breast cancer presented with 2 months of worsening hair loss 4 months after starting treatment with fam-trastuzumab deruxtecan. The patient reported using only over-the-counter Nioxin shampoo. The patient had experienced hair loss 8 years prior with cytotoxic chemotherapy and had complete regrowth of hair following treatment.

On exam, she had low follicular density with miniaturization involving the frontal and vertex scalp (**Figure 1**), thinning of eyebrows and eyelashes, and a positive hair pull test. The patient was started on 1.25 mg of oral minoxidil daily. Four months later, the patient re-presented to clinic after switching from fam-trastuzumab deruxtecan to sacituzumab govitecan due to disease progression. The patient reported an initial response to minoxidil prior to treatment change, but experienced diffuse hair loss upon starting sacituzumab govitecan. On exam, she had complete alopecia of the scalp with preservation of the follicular ostia (**Figure 2**) and patchy alopecia of the eyebrows and eyelashes. The patient's dose of minoxidil was increased to 2.5 mg daily, and she was prescribed bimatoprost for her eyebrow and eyelash loss. At follow up 4 months later, the patient reported patchy hair growth of the scalp, eyebrows, and eyelashes, as well as increased facial and body hair growth. On exam, she had short diffuse regrowth of dark hair throughout the scalp with greatest regrowth of the vertex (**Figure 3**) and patchy alopecia of the eyebrows and eyelashes. The patient was maintained on sacituzumab govitecan and minoxidil, with continued improved hair growth.

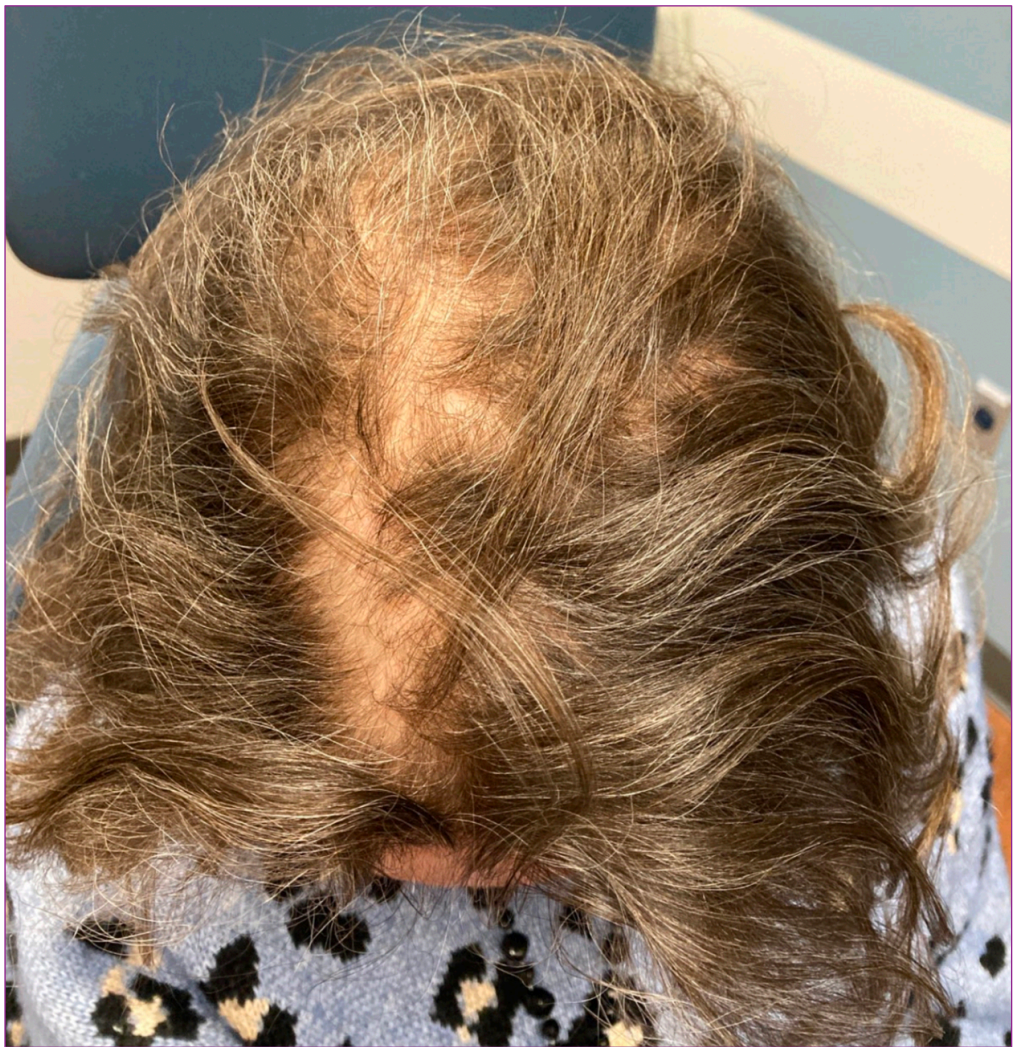

Figure 1. Physical exam findings of low follicular density with miniaturization involving the frontal and vertex scalp.

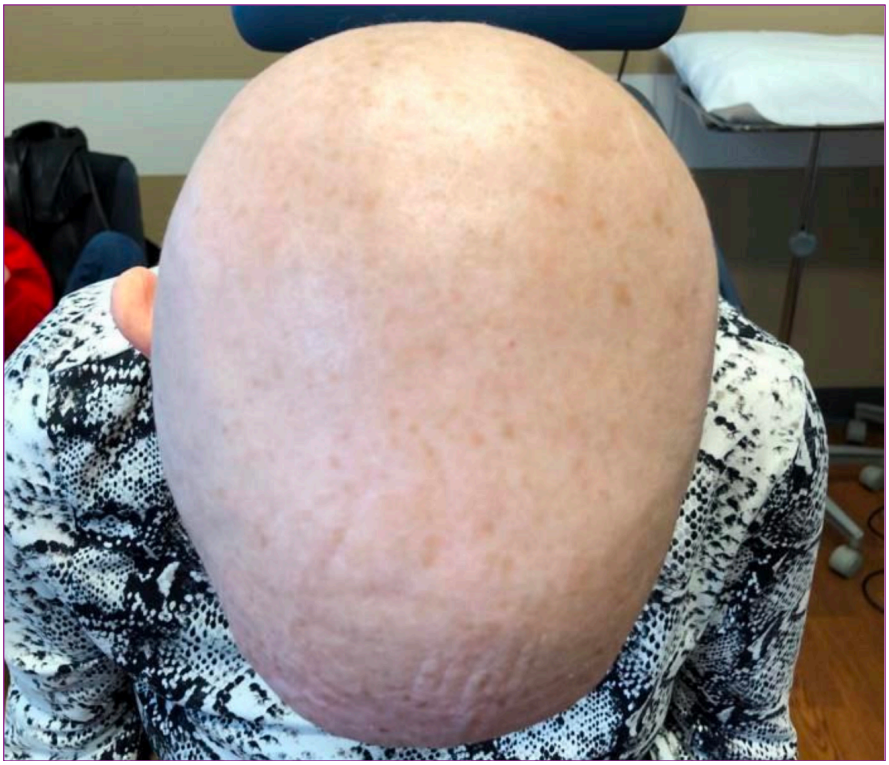

Figure 2. Physical exam findings of complete alopecia of the scalp with preservation of the follicular ostia.

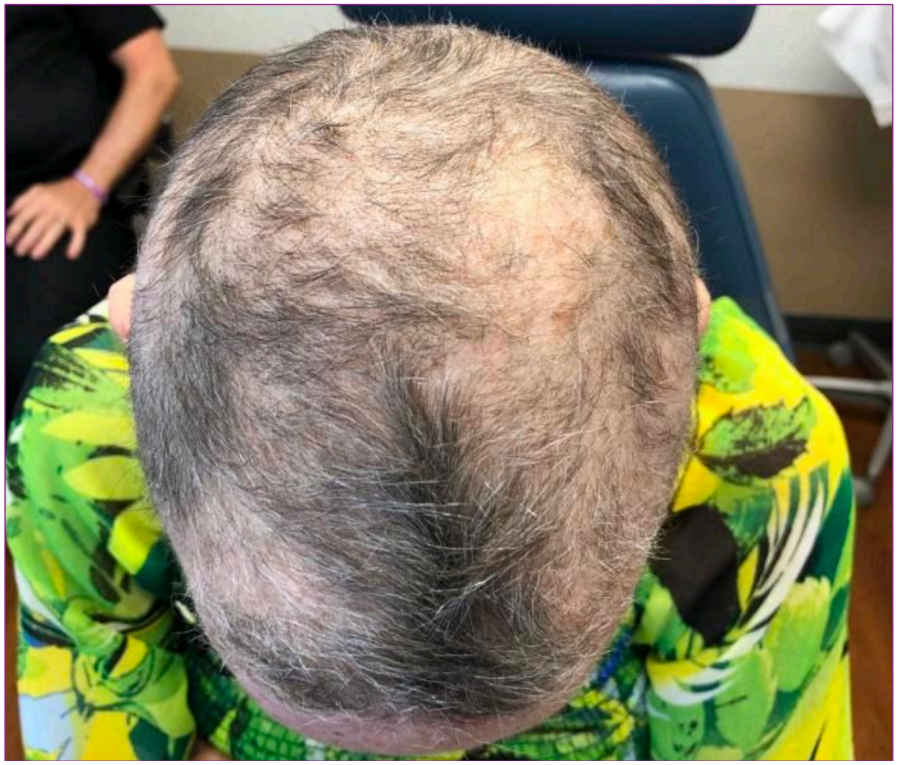

Figure 3. Physical exam findings of short diffuse regrowth of dark hair throughout the scalp with greatest regrowth of the vertex.

DISCUSSION

We report on a case of complete ADC-induced hair loss treated with oral minoxidil despite continued ADC treatment. ADCs consist of mAbs conjugated via a chemical linker to a cytotoxic drug, combining the precise tumor targeting of mAbs with the potent cell-killing abilities of chemotherapy.[1] Trastuzumab deruxtecan, a HER2-directed mAb bound to a topoisomerase 1 inhibitor payload, and sacituzumab govitecan, a humanized anti-trophoblast cell-surface antigen 2 mAb bound to SN-38, an irinotecan metabolite payload, are associated with alopecia as a common adverse effect.[2] Interestingly, our patient presented with mild hair loss in a largely androgenetic pattern while on trastuzumab deruxtecan and then experienced complete alopecia of the scalp upon switching to sacituzumab govitecan. Alopecia and other adverse effects of ADCs are suspected to be caused by off-target effects of the payload on normal cells of the body, causing similar effects to those observed in standard chemotherapy.[4]

Minoxidil is an antihypertensive medication approved for the treatment of androgenetic alopecia and female pattern hair loss.[5] It is frequently used off-label to treat other hair disorders, including chemotherapy-induced alopecia (CIA), and it can be used as an oral or topical treatment. The efficacy of minoxidil for the prevention of CIA has not been consistently demonstrated across type of malignancy or treatment regimen. Thus, minoxidil is not conventionally used while chemotherapy is administered.

There is no specific data regarding effective prevention or treatment of ADC-induced hair loss, and scalp cooling is the most frequently recommended preventative treatment.[6] Bimatoprost ophthalmic solution and topical minoxidil have been recommended to help with hair re-growth post-treatment, but there are no recommended therapies for re-growth concurrent with ADC treatment.

The ability to achieve hair re-growth caused by ADCs using oral minoxidil with continued ADC treatment has not been discussed previously in the literature. Due to our report of successful hair re-growth using oral minoxidil in a patient receiving ADC therapy, dermatologists may consider minoxidil as a treatment option for patients experiencing ADC-induced alopecia even while they are still undergoing treatment. Further research is needed to delineate the role of minoxidil for treating ADC-induced alopecia.

Conflict of Interest Disclosures: None

Funding: None

Corresponding Author:
Brittany Dulmage, MD
540 Officenter Place, Suite 240
Columbus OH, 43230
Phone: 614-293-1707
Email: Brittany.Dulmage@osumc.edu

References:

1. Fu Z, Li S, Han S, Shi C, Zhang Y. Antibody drug conjugate: the "biological missile" for targeted cancer therapy. Signal Transduct Target Ther. 2022 Mar 22;7(1):93. doi: 10.1038/s41392-022-00947-7. PMID: 35318309; PMCID: PMC8941077.
2. Fenton MA, Tarantino P, Graff SL. Sequencing Antibody Drug Conjugates in Breast Cancer: Exploring Future Roles. Curr Oncol. 2023 Nov 29;30(12):10211-10223. doi: 10.3390/curroncol30120743. PMID: 38132377; PMCID: PMC10742750.
3. Schlam I, Tarantino P, Tolaney SM. Managing adverse events of sacituzumab govitecan. Expert Opin Biol Ther. 2023 Jul-Dec;23(11):1103-1111. doi: 10.1080/14712598.2023.2267975. Epub 2023 Dec 15. PMID: 37800595.
4. Donaghy H. Effects of antibody, drug and linker on the preclinical and clinical toxicities of antibody-drug conjugates. MAbs. 2016 May-Jun;8(4):659-71. doi:

10.1080/19420862.2016.1156829. Epub 2016 Apr 5. PMID: 27045800; PMCID: PMC4966843.

5. Suchonwanit P, Thammarucha S, Leerunyakul K. Minoxidil and its use in hair disorders: a review. Drug Des Devel Ther. 2019 Aug 9;13:2777-2786. doi: 10.2147/DDDT.S214907. Erratum in: Drug Des Devel Ther. 2020 Feb 10;14:575. doi: 10.2147/DDDT.S247601. PMID: 31496654; PMCID: PMC6691938.

6. Rugo HS, Bianchini G, Cortes J, Henning JW, Untch M. Optimizing treatment management of trastuzumab deruxtecan in clinical practice of breast cancer. ESMO Open. 2022 Aug;7(4):100553. doi: 10.1016/j.esmoop.2022.100553. Epub 2022 Aug 11. PMID: 35964548; PMCID: PMC9375150.