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CASE REPORT

Intravenous Umbilical Cord Mesenchymal Stem Cell Therapy in Pediatric Alopecia Areata: A Case Report

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Abstract:

Objective: To describe the clinical outcome of intravenous umbilical cord–derived mesenchymal stem cell (UC-MSC) therapy in a 10-year-old male with treatment-resistant alopecia areata. **Methods:** A 10-year-old male with a two-year history of relapsing alopecia areata unresponsive to standard therapies received two intravenous UC-MSC infusions at 9 months apart, and the improvement documented is over a period of 16 months. Clinical assessment included serial scalp photography, Severity of Alopecia Tool (SALT) scoring, and routine laboratory monitoring. **Results:** Progressive and sustained hair regrowth was observed. The SALT score improved from 52 at baseline to 10 at final follow-up. Perifollicular erythema resolved after the initial infusion. No infusion-related adverse events or systemic complications were recorded. **Conclusion:** Intravenous UC-MSC therapy was well tolerated and associated with marked clinical improvement in this pediatric case of refractory alopecia areata. While spontaneous remission cannot be excluded, the temporal relationship between treatment and response supports further investigation of systemic MSC therapy in pediatric autoimmune hair loss.

Keywords: Alopecia Areata, Pediatric Autoimmune Disease, Mesenchymal Stem Cells, Umbilical Cord Stem Cells, Regenerative Therapy

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1. Introduction:

Alopecia areata (AA) is a chronic autoimmune disorder characterized by non-scarring hair loss resulting from immune-mediated disruption of anagen hair follicles. The condition affects approximately 1–2% of the population and commonly presents in childhood [1,2]. Although the course of disease is unpredictable, pediatric cases with early onset and relapsing disease often demonstrate poorer long-term outcomes [1].

Conventional treatments, including topical or intralesional corticosteroids, topical immunotherapy, and systemic agents such as Janus kinase (JAK) inhibitors, are frequently limited by incomplete response, relapse, or concerns regarding long-term safety in children [3,4]. These limitations have driven interest in immune-modulating strategies that target disease pathogenesis rather than symptom suppression.

Mesenchymal stem cells (MSCs), particularly those derived from umbilical cord tissue, possess potent immunomodulatory and trophic properties. Umbilical cord–derived MSCs (UC-MSCs) secrete anti-inflammatory cytokines, promote regulatory immune pathways, and support tissue repair through paracrine signaling [3,5]. This report describes the clinical course of a child with refractory alopecia areata treated with intravenous UC-MSC therapy under compassionate use.

2. Case Presentation:

Patient Profile:

A 10-year-old boy presented with a two-year history of recurrent, patchy scalp hair loss. The condition had shown minimal and transient response to topical corticosteroids and topical immunotherapy. There was no personal or family history of autoimmune disease.

Clinical examination revealed multiple alopecic patches involving the scalp, accompanied by mild perifollicular erythema. The baseline SALT score was 52, a validated measure of disease extent [1]. Routine laboratory investigations, including inflammatory markers and autoimmune screening, were unremarkable, with no evidence of systemic autoimmune or infectious disease.

Figure 1: Baseline scalp photograph demonstrated extensive patchy alopecia with mild perifollicular erythema (SALT score: 52).

Cell Source and Manufacturing Standards:

The UC-MSCs used in this case were allogeneic cells derived from donated human umbilical cord tissue obtained following informed maternal consent. Cells were processed and expanded under sterile conditions in accordance with Good Manufacturing Practice (GMP)–aligned protocols. Quality control measures included sterility testing, endotoxin screening, and viability assessment before release. Cells were cryopreserved and thawed immediately before administration.

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Treatment Protocol:

UC-MSCs were administered via intravenous infusion under close clinical monitoring. The dosing range of 1 - 1.5 million cells/kg per infusion was selected based on published MSC dosing ranges used in pediatric and autoimmune conditions, as well as institutional clinical experience with systemic MSC therapies [5,6].

Two infusions were administered as follows:

October 20, 2023 (Initial infusion): Perifollicular erythema resolved within approximately eight weeks.

July 19, 2024 (Second infusion): Early vellus hair regrowth was observed in previously alopecic areas. SALT score improved to 34.

February 26, 2025 (Follow up visit): Complete regrowth of terminal hair was achieved. SALT score improved to 10.

Figure 2: Scalp photographs at 9 months and 10 months after first infusion, showing early regrowth and resolution of erythema (SALT score: 34).

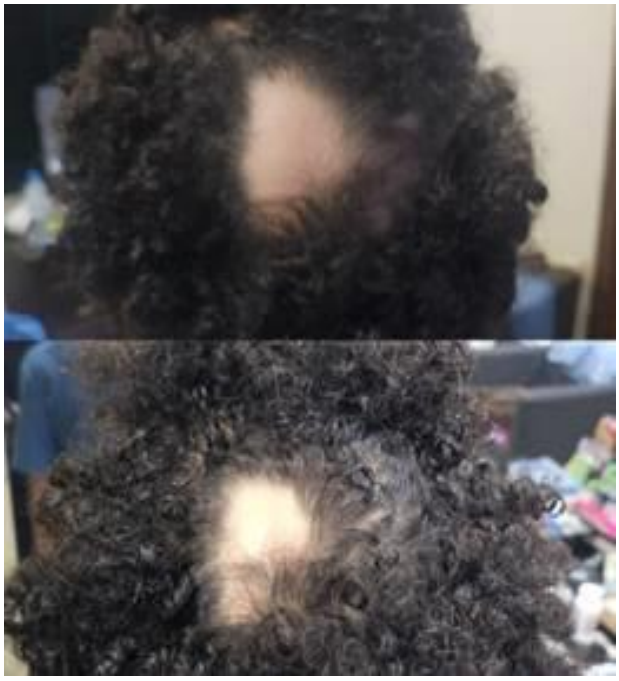

Figure 3: Scalp photograph at 4 months and 6 ½ months after the second infusion, demonstrating near-complete terminal hair regrowth (SALT score: 10).

Figure 4: Scalp photograph at follow-up visits at 7th months, 1 week after second infusion - Complete regrowth of terminal hair within the previously alopecic areas.

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The patient tolerated all infusions without adverse reactions.

Clinical Outcome:

- **Hair regrowth:** Progressive and sustained, culminating in near-complete scalp coverage.
- **Inflammation:** Resolution of perifollicular erythema following the first infusion.
- **Safety:** No hypersensitivity reactions, infections, or systemic adverse events were observed throughout follow-up.
- **Patient and family satisfaction:** High, with no clinical relapse observed at last review.

Similar patterns of hair regrowth following MSC-based therapies have been reported in both human case series and experimental models [5,6].

3. Discussion:

Alopecia areata is mediated by autoreactive T lymphocytes targeting the hair follicle, leading to collapse of follicular immune privilege and disruption of the hair growth cycle [1,2]. This immunopathogenesis supports therapeutic strategies aimed at restoring immune tolerance rather than solely suppressing inflammation.

UC-MSCs exert immunomodulatory effects through the secretion of anti-inflammatory cytokines such as interleukin-10 and transforming growth factor-β, modulation of dendritic and natural killer cell activity, and suppression of autoreactive T-cell responses [3,7]. In parallel, their paracrine release of trophic factors, including vascular endothelial growth factor and hepatocyte growth factor, may support follicular recovery and angiogenesis [8,9].

The choice of intravenous administration was intentional. While intradermal or scalp-directed approaches may offer local benefit, alopecia areata is fundamentally a systemic autoimmune disorder. Intravenous delivery allows MSCs to interact with immune cells within secondary lymphoid organs and exert broader immune-regulatory effects [6,3]. This systemic mechanism may be particularly relevant in pediatric patients with relapsing or extensive disease unresponsive to local therapies.

Although spontaneous remission is a recognized feature of alopecia areata, several factors support a treatment-associated effect in this case: the prolonged two-year history of refractory disease, the temporal association between infusions and clinical improvement, and the stepwise progression of regrowth following repeated dosing. Nonetheless, causality cannot be definitively established from a single case.

4. Limitations:

This report describes a single patient, and spontaneous remission cannot be excluded. The absence of a control group, limited biomarker analysis, and relatively short post-treatment follow-up restrict generalizability. Larger controlled studies are required to confirm efficacy, optimize dosing, and evaluate long-term relapse risk.

5. Conclusion:

This case suggests that intravenous umbilical cord–derived mesenchymal stem cell therapy may represent a promising immunomodulatory approach for pediatric alopecia areata, refractory to standard treatment. The therapy was well tolerated and associated with sustained clinical improvement [5,6,10]. These findings should be interpreted cautiously and warrant validation through rigorously designed clinical trials.

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6. Ethics and Consent:

Written informed consent was obtained from the patient's legal guardian for treatment and publication. Therapy was administered under compassionate use in accordance with international ethical standards.

These findings are consistent with prior reports/Literature Survey:

Ahn H, Lee SY, Jung WJ, Lee KH. Alopecia treatment using minimally manipulated human umbilical cord-derived mesenchymal stem cells: three case reports and review of literature. *World J Clin Cases.* 2021;9(15):3741–3751. PMC article. BioMed Central.

Li Y, Yan B, Wang H, et al. Hair regrowth in alopecia areata patients following Stem Cell Educator therapy. *BMC Med.* 2015;13:87. PMC article. PMC.

Ou K-L, Kuo Y-W, Wu C-Y, et al. The potential of a hair follicle mesenchymal stem cell-conditioned medium for wound healing and hair follicle regeneration. *Applied Sciences.* 2020;10(8):2646. (example MSC-CM / regeneration). MDPI.

Deng W, Zhang Y, Wang W, et al. Hair follicle-derived mesenchymal stem cells decrease alopecia areata mouse hair loss and reduce inflammation around the hair follicle. *Stem Cell Res Ther.* 2021; 12:548. (AA mouse model). BioMed Central.

7. Author Contribution:

- Dr. David Ikudayisi conceived and designed the treatment protocol, supervised clinical management, and reviewed the final document version.
- Dr. Darlington Amadi collected clinical data, conducted the literature review, and drafted the document.
- Dr. Olalekan Kolawole reviewed the document.
- Dr. Ikudayisi approved the final version of the report.

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9. Xiao S et al., 2020, Same study, cited for regenerative mechanism emphasis — acceptable in Vancouver style when context differs. https://stemcellres.biomedcentral.com/articles/10.1186/s13287-020-01774-8
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