

Central Centrifugal Cicatricial Alopecia (CCCA): Unraveling the Complexities of a Scarring Hair Disorder

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ABSTRACT

Central Centrifugal Cicatricial Alopecia (CCCA) represents a distinct form of scarring alopecia predominantly affecting individuals of African descent. This article provides an in-depth examination of the clinical characteristics, pathogenesis, diagnostic challenges, and evolving therapeutic strategies associated with CCCA. By synthesizing current research findings, we aim to enhance awareness, facilitate early diagnosis, and explore emerging interventions for this enigmatic hair disorder. A comprehensive understanding of CCCA is essential for clinicians to optimize patient care and contribute to ongoing efforts in advancing the field of trichology.

KEYWORDS: alopecia, skin, disease

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INTRODUCTION

Central Centrifugal Cicatricial Alopecia (CCCA) emerges as a challenging entity within the spectrum of hair disorders, characterized by progressive hair loss and scarring. Predominantly affecting individuals with textured hair, particularly those of African descent, CCCA's clinical manifestations, underlying pathophysiology, and optimal management remain topics of ongoing investigation. This article endeavors to delve into the intricacies of CCCA, navigating through its epidemiology, clinical features, histopathological findings, and the evolving landscape of diagnostic and therapeutic approaches. As we embark on this exploration, the complexities of CCCA unfold, urging the medical community to enhance awareness and refine our strategies in addressing this distinctive form of scarring alopecia.^{1,2}

PREVALENCE

CCCA exhibits a notable predilection for individuals of African descent, particularly women. Epidemiological studies indicate a higher prevalence among women of African ancestry, with an age-adjusted rate that surpasses that of other ethnic groups. The prevalence increases with age, peaking in middle adulthood. However, emerging evidence suggests an expanding recognition of CCCA in diverse populations, emphasizing the need for heightened awareness and accurate diagnosis across different ethnic backgrounds.³

RISK FACTORS

Understanding the risk factors associated with CCCA is imperative for elucidating its complex etiology. Genetic predisposition appears to play a crucial role, with familial clustering observed in affected individuals. Additionally, hairstyling practices, such as tight braiding, chemical relaxers, and heat styling, have been implicated as potential triggers for CCCA. Hormonal factors, including hormonal fluctuations and metabolic syndrome, may also contribute to the development and exacerbation of the condition.³

PATHOGENESIS

The pathogenesis of CCCA involves a cascade of inflammatory events leading to fibrosis and destruction of hair follicles. Immunogenetic factors contribute to the aberrant immune response, creating a microenvironment conducive to scarring. The role of specific immune cells, cytokines, and growth factors in the pathogenic process is an active area of research, presenting opportunities for targeted therapeutic interventions.³

GENETIC PREDISPOSITION

One pivotal facet of CCCA's risk profile involves genetic predisposition. Familial clustering has been observed in affected individuals, suggesting a hereditary component in the susceptibility to this scarring alopecia. Investigations into specific genetic markers and polymorphisms associated with

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CCCA are ongoing, with the goal of identifying individuals at heightened risk and elucidating the underlying genetic mechanisms at play.⁴

ETHNICITY AND DEMOGRAPHIC PATTERNS

CCCA exhibits a notable ethnic predilection, disproportionately affecting individuals of African descent, particularly women. Epidemiological studies indicate a higher prevalence in this demographic group, with age-adjusted rates surpassing those observed in other ethnic populations. Understanding the demographic nuances of CCCA is essential for tailoring diagnostic and therapeutic approaches to different patient populations.⁴

HAIRSTYLING PRACTICES

The role of hairstyling practices as precipitating factors for CCCA cannot be overstated. Tight braiding, the use of chemical relaxers, and frequent heat styling are implicated in the pathogenesis of this scarring alopecia. Mechanisms involving mechanical stress, follicular microtrauma, and the release of inflammatory mediators contribute to the development and progression of CCCA, emphasizing the importance of counseling patients on hair care practices.⁴

HORMONAL FACTORS

A growing body of evidence implicates hormonal factors in the risk profile of CCCA. Hormonal fluctuations, particularly in women, have been associated with the onset and exacerbation of CCCA. Additionally, the presence of metabolic syndrome, a cluster of metabolic abnormalities, has been identified as a potential risk factor, highlighting the interplay between endocrine factors and the pathogenesis of CCCA.⁴

ENVIRONMENTAL EXPOSURES

Various environmental factors may contribute to the risk of CCCA, including exposure to certain chemicals and pollutants. Investigating the role of environmental triggers, such as air pollution and occupational exposures, is an evolving area of research that may offer valuable insights into the external influences contributing to CCCA development. Central Centrifugal Cicatricial Alopecia is a chronic and progressive scarring alopecia that predominantly impacts individuals of African descent. This comprehensive exploration aims to dissect the intricate clinical manifestations of CCCA, providing clinicians with valuable insights for accurate diagnosis and tailored management strategies.⁵

CLINICAL MANIFESTATIONS

Dermatological Findings

The hallmark dermatological feature of CCCA is the gradual onset of hair loss, typically beginning at the central vertex of the scalp and radiating centrifugally. Affected areas often exhibit a shiny, smooth, and atrophic appearance, reflecting

the underlying scarring process. Inflammatory changes, such as erythema and perifollicular pustules, may be evident during active phases of the disease. Close examination reveals follicular ostia plugged with keratinaceous material, contributing to the pathognomonic clinical appearance of CCCA.^{6,7}

HISTOPATHOLOGICAL CHARACTERISTICS

Histopathological analysis plays a pivotal role in confirming the diagnosis of CCCA. Biopsies from affected scalp areas demonstrate features of scarring alopecia, including perifollicular fibrosis, lymphocytic inflammation, and the destruction of hair follicles. Follicular dropout and the replacement of hair follicles by fibrous tracts are indicative of the irreversible nature of CCCA. Immunohistochemical studies further elucidate the immune-mediated pathogenesis, highlighting the presence of specific inflammatory cells and cytokines within the affected tissue.^{6,7}

TRICHOSCOPY

Trichoscopy, a non-invasive technique for examining the scalp and hair, offers valuable insights into the clinical manifestations of CCCA. Close-up visualization reveals characteristic findings such as the "white dots" corresponding to areas of follicular hyperkeratosis and perifollicular inflammation. Additionally, the presence of cadaverized hairs, a feature unique to scarring alopecias, aids in distinguishing CCCA from other forms of hair loss.^{6,7}

PROGRESSION AND VARIANTS

CCCA exhibits a variable clinical course, with periods of stability interspersed with episodes of exacerbation. The disease may progress slowly, leading to extensive areas of scarring and irreversible hair loss. Notably, CCCA can present in various clinical variants, including the diffuse and reticulate patterns, each with distinct clinical and histological features. Recognizing these variants is crucial for tailoring management strategies based on the specific clinical presentation.^{6,7}

DIAGNOSIS

Clinical Evaluation: The initial step in diagnosing CCCA involves a thorough clinical evaluation of the scalp and hair. Dermatologists must meticulously assess the distribution, pattern, and characteristics of hair loss, with a particular focus on the central vertex and the presence of associated dermatological findings. Trichoscopic examination aids in visualizing key features such as perifollicular inflammation, follicular hyperkeratosis, and the presence of cadaverized hairs, contributing valuable diagnostic clues.^{6,7}

Histopathological Analysis: Histopathological examination remains the gold standard for confirming the diagnosis of CCCA. Scalp biopsies from affected areas reveal characteristic features of scarring alopecia, including

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perifollicular fibrosis, lymphocytic inflammation, and follicular dropout. The identification of these histopathological hallmarks, along with the exclusion of alternative diagnoses, solidifies the diagnostic certainty in cases of CCCA.^{8,9}

Trichoscopy: Trichoscopy serves as a non-invasive and complementary diagnostic tool, offering magnified visualization of the scalp and hair. The presence of specific trichoscopic findings, such as "white dots," representing follicular hyperkeratosis, aids in distinguishing CCCA from other non-scarring alopecias. The identification of cadaverized hairs and the assessment of hair shaft abnormalities further enhance the diagnostic accuracy of trichoscopy in CCCA.^{8,9}

Laboratory Investigations: While there are no specific serological markers for CCCA, laboratory investigations may be employed to rule out potential underlying systemic diseases or hormonal imbalances contributing to hair loss. Comprehensive blood work, including complete blood count, thyroid function tests, and hormonal assessments, helps in excluding secondary causes of alopecia and ensures a thorough diagnostic workup.^{8,9}

Differential Diagnosis: Given the overlapping clinical features with other forms of alopecia, establishing a differential diagnosis is crucial. Conditions such as traction alopecia, lichen planopilaris, and other scarring alopecias must be considered and systematically ruled out through a combination of clinical, histopathological, and ancillary diagnostic assessments.^{8,9}

TREATMENT

Topical Corticosteroids: Topical corticosteroids represent a cornerstone in the management of CCCA, exerting anti-inflammatory effects that help attenuate the immune response within the affected scalp. High-potency topical corticosteroids, applied directly to the affected areas, aim to reduce inflammation, alleviate symptoms, and potentially slow disease progression. Regular monitoring for side effects, including skin atrophy, is paramount to optimizing the safety and efficacy of this therapeutic approach.^{10,11}

Intralesional Corticosteroid Injections: For localized or refractory cases of CCCA, intralesional corticosteroid injections offer a targeted approach to deliver potent anti-inflammatory agents directly into affected areas. This modality aims to suppress inflammation, mitigate scarring, and potentially promote hair regrowth in select cases. Careful consideration of injection sites, dosage, and interval monitoring is essential to optimize therapeutic outcomes while minimizing adverse effects.^{10,11}

Systemic Corticosteroids: In cases of widespread or rapidly progressing CCCA, systemic corticosteroids may be considered to achieve a broader anti-inflammatory effect. However, the use of systemic corticosteroids is often reserved

for severe cases due to the associated risks of systemic side effects and the potential for disease relapse upon tapering. Close monitoring and a gradual tapering schedule are imperative to mitigate adverse effects and prevent rebound flares.^{10,11}

Immunomodulatory Agents: Immunomodulatory agents, such as hydroxychloroquine and mycophenolate mofetil, have shown promise in managing CCCA by modulating the immune response and suppressing inflammation. These agents are often considered in cases refractory to corticosteroids or as steroid-sparing options to minimize long-term corticosteroid exposure. Regular monitoring for potential side effects, including retinal toxicity with hydroxychloroquine, is crucial for safe and effective use.¹²

Emerging Therapies: Advancements in understanding the immunopathogenesis of CCCA have paved the way for emerging targeted therapies. Janus kinase (JAK) inhibitors, such as tofacitinib and ruxolitinib, are being explored for their potential to disrupt the inflammatory cascade and foster hair regrowth in CCCA. While promising, the long-term safety and efficacy of these agents in CCCA warrant further investigation through ongoing clinical trials.¹

CONCLUSION

In conclusion, the intricate landscape of Central Centrifugal Cicatricial Alopecia (CCCA) underscores the complexity of its pathogenesis, clinical manifestations, diagnosis, and therapeutic interventions. This comprehensive review has illuminated the multifaceted nature of CCCA, emphasizing the need for a holistic and nuanced approach in both understanding and managing this challenging scarring alopecia.

The clinical manifestations of CCCA, ranging from the insidious onset of hair loss with characteristic central involvement to the atrophic and shiny appearance of affected areas, pose a diagnostic puzzle that requires meticulous evaluation. Dermatological findings, histopathological characteristics, and ancillary diagnostic tools such as trichoscopy collectively contribute to the accurate diagnosis of CCCA, allowing clinicians to differentiate it from other alopecias and guide tailored therapeutic interventions.

The therapeutic landscape of CCCA encompasses a spectrum of interventions, from conventional topical and intralesional corticosteroids to systemic immunomodulatory agents and emerging targeted therapies like Janus kinase inhibitors. Each modality, while offering potential benefits, necessitates careful consideration of risks, monitoring for adverse effects, and an individualized approach based on disease severity and patient factors.

While progress has been made in elucidating the genetic, environmental, and immunological factors contributing to CCCA, further research is warranted to deepen our understanding of this enigmatic condition. Ongoing clinical

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trials investigating novel therapies, such as JAK inhibitors, hold promise for advancing the therapeutic armamentarium and improving outcomes for individuals grappling with CCCA.

In summary, the journey through CCCA demands a collaborative effort among dermatologists, researchers, and patients. Heightened awareness, early diagnosis, and tailored therapeutic strategies are pivotal in addressing the challenges posed by this chronic scarring alopecia. As our knowledge continues to evolve, the integration of emerging research findings into clinical practice will undoubtedly enhance our ability to navigate the complexities of CCCA, ultimately improving the quality of life for those affected by this intriguing and challenging dermatologic condition.

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