Eccrine Duct Dilation as a Marker of Cicatricial Alopecia

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Background: Eccrine duct dilation (EDD) and syringoma-like sweat duct proliferation have been described as reactive changes occurring in a variety of skin conditions. However, extensive evaluation of EDD in scalp biopsies performed for alopecia has not been performed.

Methods: We retrospectively examined 129 cases of cicatricial alopecia (lichen planopilaris, central centrifugal cicatricial alopecia, and discoid lupus erythematosus) and 130 cases of noncicatricial alopecias (androgenetic alopecia, telogen effluvium, and alopecia areata) for the presence of EDD.

Results: Overall, EDD occurred in 4% (5/130) of noncicatricial alopecia (2/43 of androgenetic alopecia, 0/15 of telogen effluvium, 3/72 of alopecia areata) and 35% (45/129) of cicatricial alopecia (10/31 of lichen planopilaris, 17/36 central centrifugal cicatricial alopecia, and 18/62 of discoid lupus erythematosus; $P < 0.0001$) cases.

Conclusions: EDD can infrequently occur in noncicatricial alopecias; however, the frequency of dilation is significantly increased in cicatricial alopecias. This alteration may be due to compressive or inflammatory effects inherent to the scarring process. The presence of EDD may be a useful adjunctive histopathologic feature in the diagnosis of cicatricial alopecias.

Key Words: cicatricial, scarring, alopecia, eccrine duct, dilation

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INTRODUCTION

The evaluation of scalp biopsies submitted for alopecia is challenging. Review of the histologic sections often requires an extensive search of key histopathologic features that lead to the proper diagnosis. However, in nonoptimal specimens, such as cases submitted for vertical section only or cases with a limited amount of tissue, the diagnosis can be difficult. In addition, clinical correlation is important; however, clinical information may not always be provided to the dermatopathologist. Furthermore, establishing the diagnosis is crucial because treatment and prognosis for hair regrowth differ greatly.

Alterations of the eccrine sweat glands have been described in a variety of skin conditions, including neoplastic and inflammatory processes.[1,2] In the scalp, syringomas and syringoma-like sweat duct proliferation are uncommon patterns of eccrine sweat gland alteration that have been described in both cicatricial and noncicatricial alopecias.[2–10] In the context of cicatricial alopecia, some authors believed this phenomenon to be incidental findings,[8] whereas other authors believed that eccrine sweat duct hamartomas and syringomas cause cicatricial alopecia[4,9–11] and progressive hair loss.[3]

Another pattern of eccrine sweat duct alteration includes eccrine duct dilation (EDD). EDD has been defined as cystic dilation of the eccrine duct to more than double its usual size.[1] It is more frequently encountered than scalp syringomas and has been described as the most common histologic variation seen in eccrine ducts.[1] EDD has been described in association with central centrifugal cicatricial alopecia (CCCA) in a study in African American patients,[12] where it was found in 17 of 25 cases. In addition, although syringomas and syringoma-like sweat duct proliferation have been described in both cicatricial and noncicatricial alopecias, it is unclear whether EDD may have a role in distinguishing between the two.

To date, the evaluation of EDD in scalp biopsies submitted for alopecia has not been systematically examined. In this study, we compared the frequency of EDD in cicatricial and noncicatricial alopecias and evaluated its possible role as a marker of cicatricial alopecia.

MATERIALS AND METHODS

Case Selection

The study was approved by the Institutional Review Board at the Northwestern University and was carried out in accordance with the guidelines for human subject research. Cases of cicatricial and noncicatricial alopecia submitted to the Division of Dermatopathology at the Northwestern Memorial Hospital between 2008 and 2015 were identified through a retrospective search of the pathology database. For the cicatricial alopecia group, cases of lichen planopilaris (LPP), CCCA, and discoid lupus erythematosus (DLE) were identified. The noncicatricial alopecia group served as controls and cases of androgenetic alopecia (AGA), telogen effluvium (TE), and alopecia areata (AA) were identified. The original specimens were formalin fixed, paraffin embedded and cut to a thickness of 6–8 μm. Hematoxylin and

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eosin–stained sections were reviewed by 3 dermatopathologists (J.G., P.G., and P.Y.). Cases were included in the study if the sections had the presence of eccrine ducts, and the histopathologic findings led to an unambiguous diagnosis of either cicatricial or noncicatricial alopecia. Both horizontal and vertical hematoxylin and eosin–stained sections were then evaluated for the presence of EDD, which was defined as 1 or more cystically dilated ducts that were twice the size or greater than the background eccrine ducts. Only rare cases were excluded based on the absence of eccrine ducts with or without dilation.

Statistical Analysis

Statistical analysis was performed using IBM SSPS Statistics (International Business Machines Corporation, Armonk, NY). The Fischer exact test was used to assess the difference in the presence of EDD between cicatricial and noncicatricial alopecias. A P value of <0.05 was considered statistically significant.

RESULTS

A total of 259 cases were evaluated in our study. Overall, 129 cases of cicatricial alopecia (31 of LPP, 36 of CCCA, and 62 of DLE) and 130 cases of noncicatricial alopecia (43 of AGA, 15 of TE, and 72 of AA) were identified.

EDD was seen in both cicatricial and noncicatricial alopecias. Within the cicatricial alopecia group, EDD was present in 10 (32%) of 31 cases of LPP, 17 (47%) of 36 cases of CCCA, and 18 (29%) of 62 cases of DLE. Within the noncicatricial alopecia group, EDD was present in 2 (5%) of 43 cases of AGA, 0 (0%) of 15 cases of TE, and 3 (4%) of 72 cases of AA. Overall, EDD was identified in 45 (35%) of 129 cases of cicatricial alopecias and 5 (4%) of 130 cases of noncicatricial alopecias. This difference was statistically significant with a P value of <0.0001 (Table 1).

Morphologically, EDD was characterized by cystically dilated eccrine ducts composed of a single to double layer of flat, cuboidal, eosinophilic cells, some with luminal secretions (Fig. 1). Virtually, in all the cases evaluated, both cicatricial and noncicatricial EDD was present singly (Figs. 2 and 3). In 1 case of CCCA, there was dilation of 5 eccrine ducts in a single ×10 field. Normal eccrine ducts were also identified at all levels of the hair follicle (bulbar, suprabulbar, isthmus, and infundibular levels). Likewise, EDD was identified at all levels of the hair follicle and appeared to be most pronounced in areas adjacent to the scarring process. The extent of EDD in cicatricial alopecia cases had dilation approaching 5–6 times the size of the background eccrine ducts, whereas in noncicatricial alopecia cases, dilation was typically 2–3 times the size of background ducts.

TABLE 1. Summary of Results

Diagnosis	Cases with EDD, n (%)	Total Cases, n	P
Cicatricial alopecia	45 (35)	129	<0.0001
LPP	10 (32)	31	
CCCA	17 (47)	36	
DLE	18 (29)	62	
Noncicatricial alopecia	5 (4)	130	<0.0001
AGA	2 (5)	43	
TE	0 (0)	15	
AA	3 (4)	72	

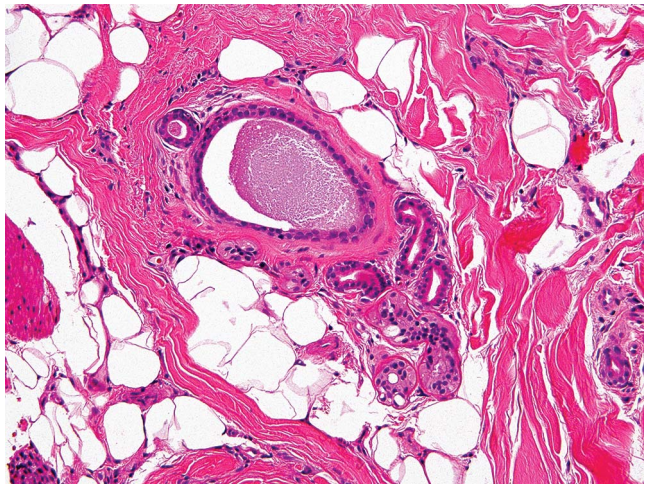

FIGURE 1. Horizontal section of CCCA with EDD. Morphologically characterized by a cystically dilated eccrine duct with a single to double layer of flat cuboidal eosinophilic cells with luminal secretions.

DISCUSSION

EDD and syringoma-like sweat duct proliferation have been reported in a variety of skin conditions.[2,8] In scalp biopsies, there have been numerous case reports describing syringomas and syringoma-like proliferation in association with alopecia.[2–10] In addition, Mehregan and Mehregan[8] reviewed 585 scalp biopsies and suggested that syringoma-like sweat duct proliferation (defined as the presence of at least 5 or more cystically dilated ducts aggregated in 1 area) is a reactive process that plays no significant role in hair loss. Our study evaluated single-gland dilation and its association with cicatricial and noncicatricial alopecia.

EDD was present in both cicatricial and noncicatricial alopecias. Normal eccrine ducts are present in all skin sites at varying densities, and they play a role in heat control and aspects of metabolism. Dobson et al[13] investigated the morphologic alterations of sweat glands in physiologic processes and described mild cystic dilation that regularly occurs in persistent sweating. Additionally, the morphologic alterations are fully reversible.[13] Indeed, at baseline, there is physiologic EDD required for heat control function, which may correspond to the low frequency of EDD seen in noncicatricial alopecias. In contrast, EDD was identified at a greater frequency in cicatricial alopecias. Interestingly, when identified in cicatricial alopecias, EDD was often directly adjacent to an overt scarring process with inflammation and fibrosis compressing or "pinching" the eccrine

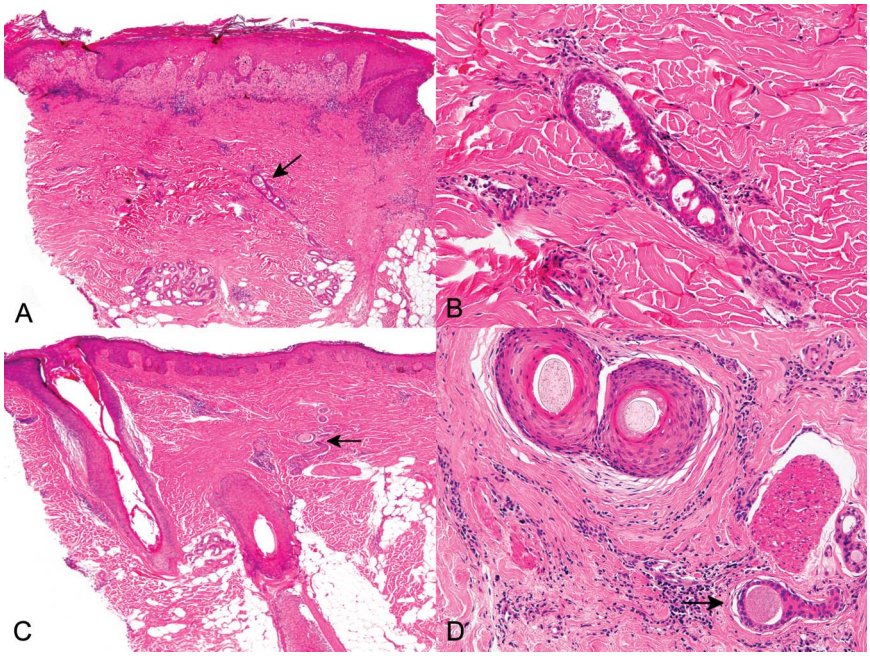

FIGURE 2. EDD in cicatricial alopecias. A, Low-power vertical section of LPP characterized by band-like lichenoid infiltrate with sawtoothing of the rete ridge. EDD is adjacent to the scarring process (arrow) (hematoxylin and eosin, ×2). B, High-power view of EDD as seen in (A) (hematoxylin and eosin, ×20). C, Low-power vertical section of CCCA characterized eccentric thinning of the root sheath, perifollicular fibroplasia, and follicular plugging. EDD is adjacent to the scarring process (arrow) (hematoxylin and eosin, ×2). D, High-power horizontal section of LPP demonstrating EDD adjacent to scarring process (arrow) (hematoxylin and eosin, ×20).

ducts with corresponding EDD. It may be possible that the scarring process impedes the reversibility of the morphologic changes described by Dobson et al, making it more likely to find EDD on a static hematoxylin and eosin–stained section. Our findings suggest that although there is baseline EDD, this pattern of eccrine duct alteration may be exacerbated by compressive or inflammatory effects inherent to the scarring process.

Our study evaluated a variety of alopecias in both the cicatricial group (LPP, CCCA, and DLE) and noncicatricial group (AGA, TE, and AA). The presence of EDD at an increased frequency in cicatricial alopecia (range of EDD, 29%–47%) compared with noncicatricial alopecia (range of EDD, 0%–5%) further supports that the morphologic alterations may be due to scarring and inflammation and that this finding more frequently occurs in cicatricial alopecia, independent of the subtype. Furthermore, the increased frequency of EDD observed in our cases is in concordance with studies evaluating syringoma-like sweat duct proliferation.[3,5–9] In a study by Miteva and Tosti,[12] EDD was found in 17 (68%) of 25 cases of CCCA. Our study had similar findings whereby EDD was found in 17 (47%) of 36 cases of CCCA.

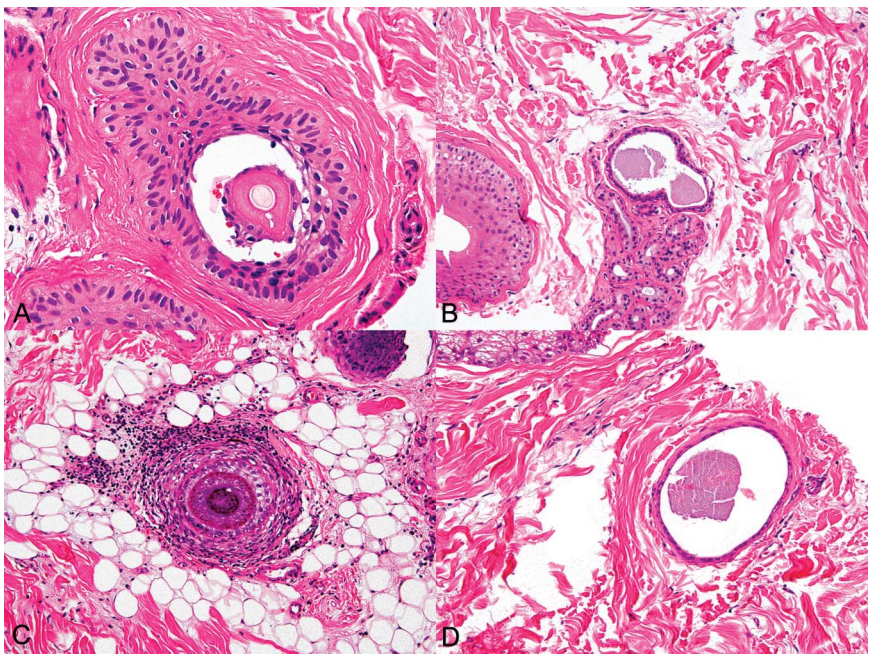

FIGURE 3. EDD in noncicatricial alopecias. A, Horizontal section of AGA characterized by miniaturization of the hair shaft (hematoxylin and eosin, ×20). B, EDD is identified on the same section as (A) (hematoxylin and eosin, ×20). C, Horizontal section of AA characterized by a "swarm-of-bees" lymphocytic infiltrate involving the deep hair follicle (hematoxylin and eosin, ×20). D, EDD is identified on the same section as C (hematoxylin and eosin, ×20).

Although EDD was predominantly identified singly, a rare case of CCCA showed 5 cystically dilated eccrine ducts morphologically similar to syringoma-like proliferation.[8] This suggests that EDD and syringoma-like sweat duct proliferation may lie on a spectrum of reactive eccrine duct changes secondary to dermal fibrosis and inflammation. EDD was often identified adjacent to the scarring changes; however, the degree of inflammatory infiltrate differed. In the cases of LPP and CCCA, EDD was found adjacent to a scarring process with minimal surrounding inflammation. In contrast, in cases of DLE, EDD was found adjacent to a scarring process often with a brisk inflammatory infiltrate. These findings may be related to inherent properties of the scarring alopecia subtype. In DLE, there is a prominent superficial and deep inflammatory infiltrate sometimes involving the eccrine ducts, whereas in LPP and CCCA, the ducts are typically spared of inflammation. Although the corresponding inflammatory infiltrate differed among the cicatricial alopecias, the morphology of duct dilation itself was similar in all cases. Additionally, we did not find eccrine gland atrophy as previously described in cases reports of alopecia related to linear morphea.[14]

Our study did not evaluate all subtypes of cicatricial alopecia. Although considered a form of noncicatricial alopecia, traction alopecia was not evaluated in this study due to its biphasic nature whereby the presence of scarring can sometimes be seen in late stages of the disease but is not typical of early stage disease. Additionally, our study was limited to the lymphocytic cicatricial alopecias. The incidence of EDD in alopecias with neutrophilic infiltrates, including dissecting cellulitis of the scalp, folliculitis decalvans, tufted folliculitis, and acne keloidalis nuchae may be the subject of future investigations.

In conclusion, EDD can infrequently occur in noncicatricial alopecias; however, the frequency of dilation is significantly increased in cicatricial alopecias. Our findings suggest that the identification of EDD on hematoxylin and eosin–stained sections of the scalp may be a useful adjunctive histopathologic feature in the diagnosis of cicatricial alopecia.

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