Original Article

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Nevus Sebaceus of Jadassohn: A Clinicopathological and Dermoscopic Study with Management Implications

Jadassohn'un Nevus Sebaseus'u: Klinikopatolojik ve Dermoskopik Bulgular ile Tedaviye Yönelik Çıkarımlar

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ABSTRACT

Objective: Nevus sebaceus (NS) of Jadassohn is a congenital hamartoma that undergoes stage-dependent morphological changes. Although malignant transformation is rare, long-term monitoring is advised. To describe the clinical, dermoscopic, and histopathological features of NS and to assess dermoscopy-histopathology correlations.

Methods: Twenty-five patients were retrospectively analyzed over 2.5 years. All patients underwent clinical staging and dermoscopy. Biopsy procedures were performed in 15 patients, and complete histopathological data suitable for analysis were available for 13 (52.0%) patients. Fisher's exact and Spearman's correlation tests were used.

Results: Mean age was 17.9±11.9 years (range: 3-43); 56.0% were male. Lesions were mainly on the scalp (60.0%). Clinical staging identified infantile (28.0%), early proliferative (24.0%), verrucous (32.0%), and nodular (16.0%) lesions. Mean age differed significantly across stages (analysis of variance, p=0.045), though overlap between groups suggested staging is not determined by age alone. Yellowish globules were significantly associated with early stages (p=0.005), whereas grayish papillary structures were confined to advanced stages (p=0.005). Arborizing vessels and brown globules were more frequent in advanced lesions but not statistically significant. Histopathology revealed basaloid epidermal proliferation, immature hair follicles, immature sebaceous glands, and

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Amaç: Jadassohn'un nevus sebaseus'u (NS), evreye bağlı morfolojik değişiklikler gösteren konjenital bir hamartomdur. Malign transformasyon nadirdir ancak uzun dönem takip önerilmektedir. Bu çalışmanın amacı, NS'nin klinik, dermoskopik ve histopatolojik özelliklerini tanımlamak ve dermoskopi-histopatoloji korelasyonlarını değerlendirmektir.

Yöntemler: NS tanılı 25 hasta 2,5 yıllık bir sürede retrospektif olarak incelendi. Tüm olgularda klinik evreleme ve dermoskopik değerlendirme yapıldı. On beş hastada biyopsi uygulanmış olup, analiz için uygun ayrıntılı histopatolojik veri 13 hastada (%52,0) mevcuttu. Fisher's exact ve Spearman korelasyon testleri kullanıldı.

Bulgular: Ortalama yaş 17,9±11,9 yıl (dağılım: 3-43) olup, hastaların %56,0'sı erkekti. Lezyonlar en sık skalpte (%60,0) izlendi. Klinik evreler; infantil %28,0, erken proliferatif %24,0, verrüköz %32,0 ve nodüler %16,0 olarak dağıldı. Ortalama yaş evreler arasında anlamlı farklılık gösterdi (varyans analizi, p=0,045), ancak gruplar arası örtüşme evrelemenin yalnızca yaşa bağlı olmadığını düşündürdü. Sarımsı globüller erken evrelerle anlamlı ilişkiliydi (p=0,005), gri papilliform yapılar ise yalnızca ileri evrelerde görüldü (p=0,005). İnce arborizan damarlar ve kahverengi globüller ileri evrelerde daha sık olmakla birlikte anlamlı bulunmadı. Histopatolojik incelemede bazaloid epidermal proliferasyon, immatür saç folikülleri, immatür sebase bezler ve perifoliküler inflamasyon yaygın

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ABSTRACT

perifollicular inflammation as common features. No statistically significant dermoscopy-histopathology associations were identified. No malignant transformation was observed.

Conclusion: Dermoscopy provides stage-dependent diagnostic clues in NS and complements histopathology as a non-invasive tool for evaluation and follow-up. Conservative surveillance may be appropriate in selected low-risk cases, whereas surgical excision remains recommended for advanced or clinically suspicious lesions.

Keywords: Nevus sebaceus, dermoscopy, trichoscopy, histopathology, sebaceous gland hyperplasia, adnexal tumors, trichoblastoma, basal cell carcinoma, RASopathy, cutaneous hamartoma

ÖZ

bulgulardı. Dermoskopik ve histopatolojik bulgular arasında istatistiksel olarak anlamlı bir ilişki saptanmadı. Malignite gözlenmedi.

Sonuç: Dermoskopi, NS'ta evreye bağlı tanısal ipuçları sağlar ve histopatolojiyi tamamlayıcı, non-invaziv bir değerlendirme aracı olarak öne çıkar. Düşük riskli olgularda konservatif izlem uygun olabilirken, ileri evre veya klinik olarak şüpheli lezyonlarda cerrahi eksizyon önerilmektedir.

Anahtar Kelimeler: Nevus sebaseus, dermoskopi, trikoskopi, histopatoloji, sebase bez hiperplazisi, adneksal tümör, trikoblastom, bazal hücreli karsinom, RASopati, deri hamartomu

Introduction

Nevus sebaceus (NS) of Jadassohn is a congenital cutaneous hamartoma characterized by sebaceous hyperplasia and adnexal abnormalities of the epidermis, pilosebaceous units, and sweat glands. The term organoid nevus has also been used to emphasize its multi-lineage adnexal differentiation. Clinically, NS progresses through distinct stages: in infancy, it appears as a smooth, hairless, yellowish plaque; during puberty, hormonal influences induce sebaceous hyperplasia, epidermal thickening, and a verrucous transformation (1,2).

NS may occur sporadically or with syndromic associations that include extracutaneous manifestations. Its prevalence is estimated at 0.1-0.3% in newborns, it predominantly involves the head and neck, and it is often accompanied by localized alopecia due to the absence of terminal follicles (3,4).

Histologically, infantile lesions show immature sebaceous lobules and reduced hair follicles, whereas adolescence triggers epidermal hyperplasia and adnexal enlargement. Recently, "sebaceous holes" have been proposed as a histological clue that helps distinguish NS from classic sebaceous hyperplasia (5). In adulthood, secondary tumors may develop—predominantly benign adnexal neoplasms such as syringocystadenoma papilliferum and trichoblastoma—while malignant potential appears low; basal cell carcinoma risk is generally estimated at <1% (2,6).

At the molecular level, NS is classified as a mosaic RASopathy caused by postzygotic activating mutations in Harvey rat sarcoma viral oncogene homolog or Kirsten rat sarcoma viral oncogene homolog, which result in constitutive activation of the RAS/mitogen-activated protein kinase (MAPK) and phosphoinositide 3-kinase-AKT pathway signaling pathways (7-9). These aberrant signaling cascades underlie the characteristic adnexal differentiation, sebaceous hyperplasia, and stage-dependent clinical evolution of the lesion. Differential diagnoses include epidermal nevus, nevoid sebaceous hyperplasia (NSH), sebaceous hyperplasia, and *aplasia cutis congenita* (ACC), and several cases have been misclassified due to overlapping clinical features (10-12). Moreover, epidermal nevus shares similar mutational profiles and clinicopathologic characteristics, placing both entities along the same spectrum of mosaic RASopathies (13). These sequential molecular and clinicopathological transitions are summarized schematically in Figure 1.

The mainstay of management remains complete excision in lesions with suspected neoplastic change; Mohs micrographic surgery is preferred in malignant transformation, while ablative and laser-based modalities may provide cosmetic benefits but carry a risk of recurrence (14). Despite multiple descriptive reports, quantitative data integrating clinical staging, dermoscopic patterns, and histopathological correlations remain limited. This study therefore aimed to investigate the clinical, dermoscopic, and histopathological features of NS in a well-defined cohort, with emphasis on stage-dependent findings and their implications for diagnosis and management (15,16).

Methods

Study Design and Study Population

This retrospective observational study was conducted at Nizip State Hospital, a public secondary care center in Gaziantep, Türkiye, over a 2.5-year period (2023-2025). Consecutive patients with a diagnosis of NS were screened; twenty-five met eligibility criteria and underwent standardized clinical and dermoscopic evaluation. Biopsy procedures were performed in 15 patients, and complete histopathological data suitable for detailed evaluation were available for 13 cases. The inclusion criterion was clinically and/or histopathologically confirmed NS with dermoscopic documentation. Exclusion criteria were incomplete records, absence of dermoscopic documentation, insufficient clinical/dermoscopic criteria for NS or histopathological findings incompatible with NS, extensive concomitant conditions likely to confound assessment (e.g., widespread epidermal nevus, congenital melanocytic nevus, inflammatory dermatoses), and

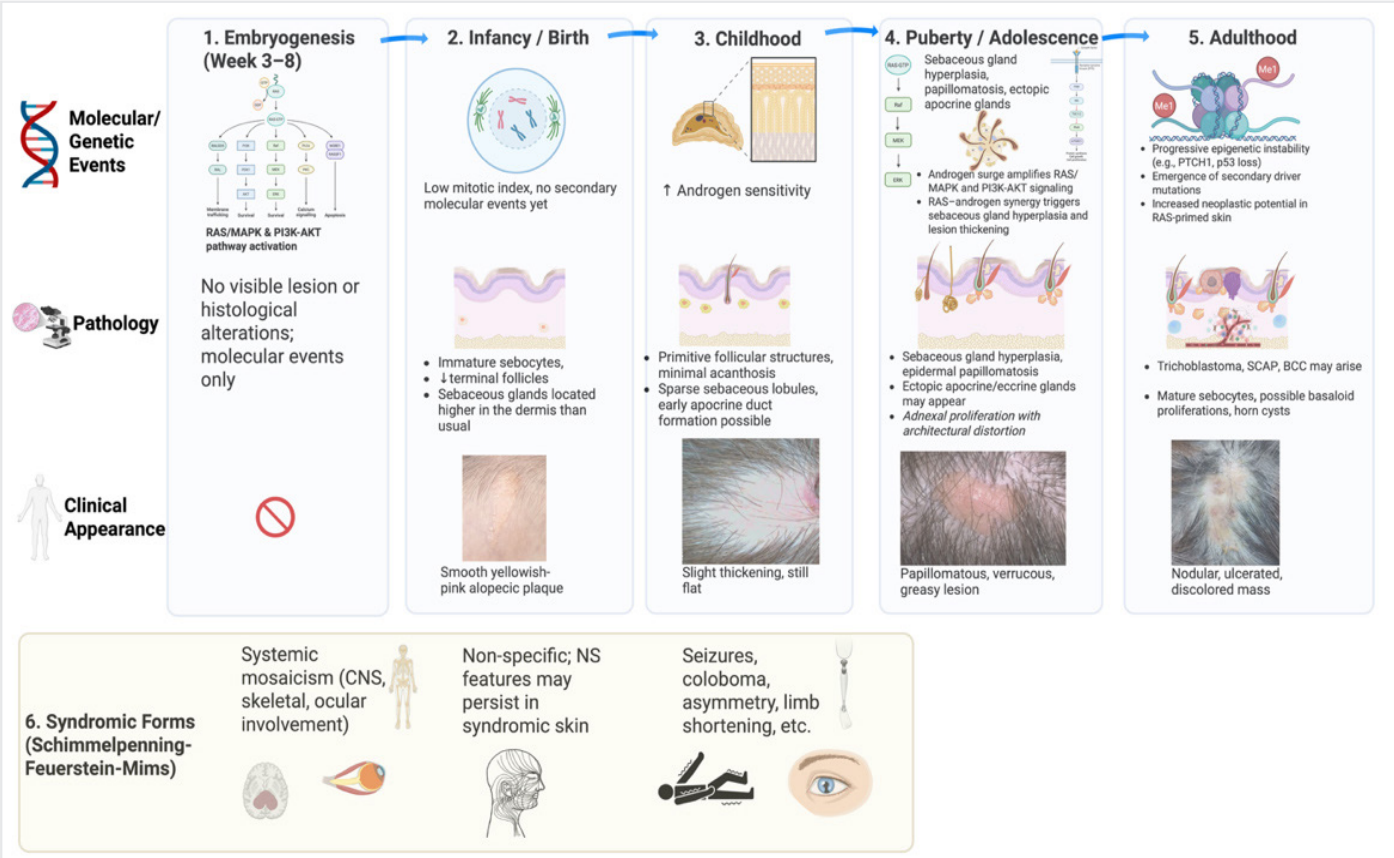

Figure 1. Timeline-based schematic representation of the molecular, histopathological, and clinical evolution of NS

Postzygotic HRAS or KRAS pathogenic variants that occur during embryogenesis initiate mosaic RASopathy, resulting in localized skin lesions. The persistent activation of the RAS/MAPK and PI3K-AKT pathways, exacerbated by pubertal androgens, drives sebaceous hyperplasia and adnexal architectural changes. Histopathologic findings progress with age, transitioning from immature sebocytes and absent terminal follicles to sebaceous proliferation, and potential neoplasia. Clinical features follow this trajectory, evolving from smooth alopecic plaques in infancy to papillomatous or nodular lesions in adulthood. Syndromic forms, such as Schimmelpenning-Feuerstein-Mims syndrome, reflect systemic mosaicism with CNS, ocular, and skeletal involvement. Additionally, NS-associated sebocytes may exhibit endocrine-like activity, secrete cytokines, and respond to neurohormonal stimuli, thereby modulating the progression of lesions and local immunity

HRAS: Harvey rat sarcoma viral oncogene homolog, KRAS: Kirsten rat sarcoma viral oncogene homolog, MAPK: Mitogen-activated protein kinase, PI3K-AKT: Phosphoinositide 3-kinase-AKT pathway, CNS: Central nervous system, NS: Nevus sebaceus, BCC: Basal cell carcinoma

suspected but unconfirmed syndromic NS. Conservatively managed patients were followed annually with clinical and dermoscopic assessment for at least one year to document stability.

Clinical and Dermoscopic Evaluation

Demographics (age, sex), lesion site, surface morphology, and associated features (alopecia, verrucous texture, pigmentation) were recorded. Clinical and dermoscopic staging followed published criteria (15,16). Briefly, the infantile stage shows clustered yellow globules on a pale-yellow or pink background with preserved follicular openings; the early proliferative plaque stage is characterized by lobulated, cobblestone-like yellow structures occasionally with perifollicular change; the verrucous stage presents a cerebriform surface with yellow-white scaling or crusting, polymorphous vascular patterns, and partial follicular obliteration; and the advanced or nodular stage exhibits nodular surface architecture, dense keratinization, complete follicular loss, and atypical vascular structures (e.g., fine arborizing or irregular vessels) that may prompt closer surveillance.

Dermoscopy was performed using a DermLite DL5 at 10× magnification (DermLite, San Juan Capistrano, CA, USA), and images were archived in secure digital repositories. Age and lesion site were recorded but not used for staging. Representative clinical and dermoscopic images across different evolutionary stages of NS are presented in Figure 2. Representative differentials excluded from the cohort, such as epidermal nevus, ACC, NSH, juvenile xanthogranuloma, and temporal triangular alopecia, are illustrated in Figure 3.

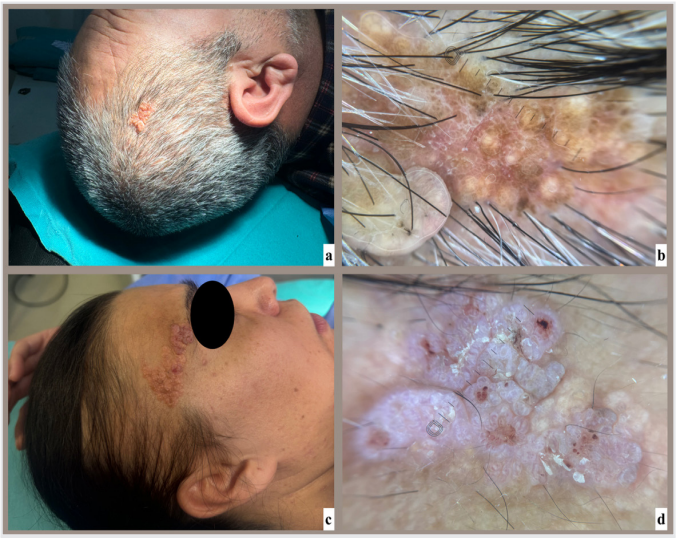

Figure 2. Clinical and dermoscopic features of nevus sebaceus (NS)

(a) Clinical image of a 43-year-old male patient presenting with a well-demarcated, yellowish verrucous plaque on the vertex scalp, showing partial alopecia and irregular surface texture. (b) Dermoscopic view of the same lesion revealing clustered yellow lobular structures, a cerebriform pattern, loss of follicular openings, and fine arborizing vessels—typical of advanced-stage NS. (c) Clinical presentation of a 34-year-old female with a brownish, verrucous plaque in the frontal region extending to the hairline, accompanied by localized alopecia. (d) Dermoscopic features of the same lesion showing whitish lobulated structures, polymorphous and fine linear vessels, along with crusted erosions—consistent with the verrucous stage of NS

Histopathological Evaluation

Biopsy specimens were fixed in 10% neutral-buffered formalin, routinely processed, paraffin-embedded, and stained with hematoxylin and eosin. Where adnexal differentiation or neoplasia was suspected, additional immunohistochemical stains were applied according to standard diagnostic practice. Microscopic assessment encompassed epidermal changes (acanthosis, papillomatosis, basal layer pigmentation), follicular structures (terminal hair development, follicular differentiation, perifollicular inflammation), and adnexal elements (presence and maturity of sebaceous glands, sebaceous hyperplasia, and eccrine or apocrine ductal proliferation). Illustrative dermoscopy-histopathology pairings are shown in Figure 4.

Ethical Approval Statement

This study was conducted in accordance with the principles of the Declaration of Helsinki and adhered to Good Clinical Practice guidelines. Ethical approval was obtained from the Scientific Research Ethics Committee of the affiliated Bezmialem Vakıf University (approval no: E-54022451-050.04-194650, decision no: 2025/185, date: 24.05.2025).

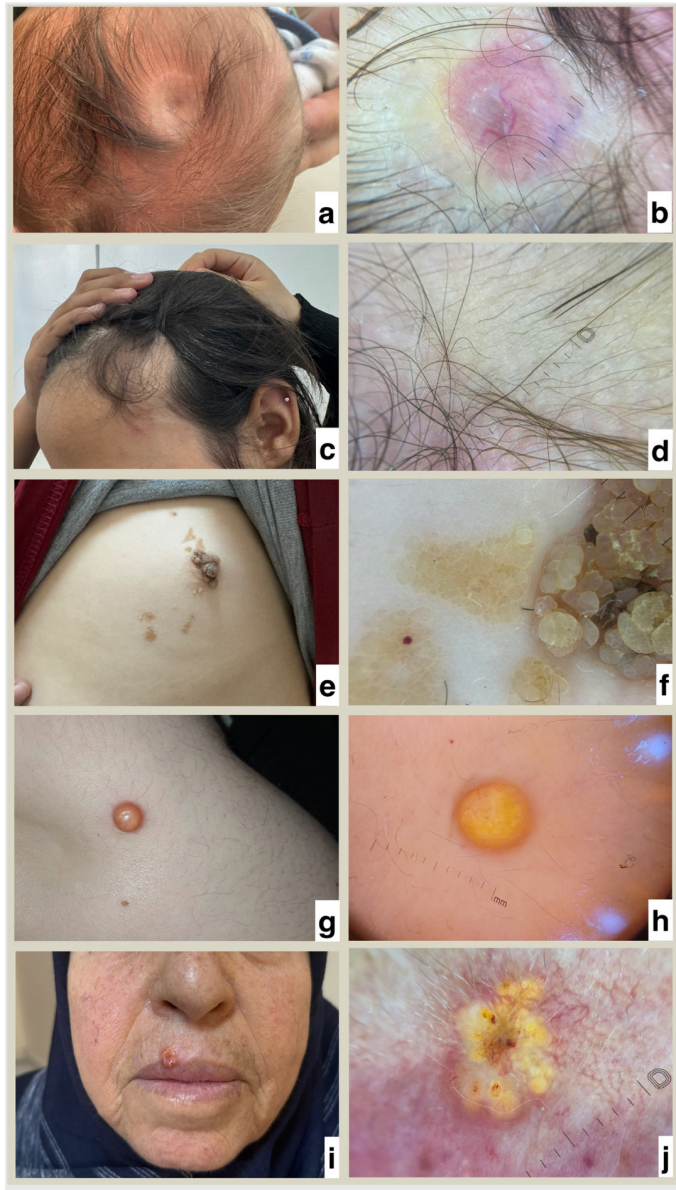

Figure 3. Clinical and dermoscopic appearances of conditions considered in the differential diagnosis of nevus sebaceus

Representative clinical (left column) and dermoscopic (right column) images of disorders excluded from the study but resembling nevus sebaceus are shown. *Aplasia cutis congenita* (a,b) presents as an atrophic alopecic plaque with a smooth shiny surface, with dermoscopy revealing a white structureless area and absence of follicular openings. Temporal triangular alopecia (c,d) appears as a triangular alopecic patch with preserved follicular openings, and dermoscopy demonstrates numerous vellus hairs on a normal scalp background. Epidermal nevus (e,f) presents as a papillomatous pigmented plaque, with dermoscopy showing brownish papillomatous structures and a cerebriform surface. Juvenile xanthogranuloma (g,h) is characterized by a dome-shaped yellow-orange papule, with dermoscopy revealing homogeneous yellow-orange areas and fine linear vessels. Nevoid sebaceous hyperplasia (i,j) manifests as a yellowish lobulated plaque, dermoscopically demonstrating enlarged yellow lobules with crown-like vessels

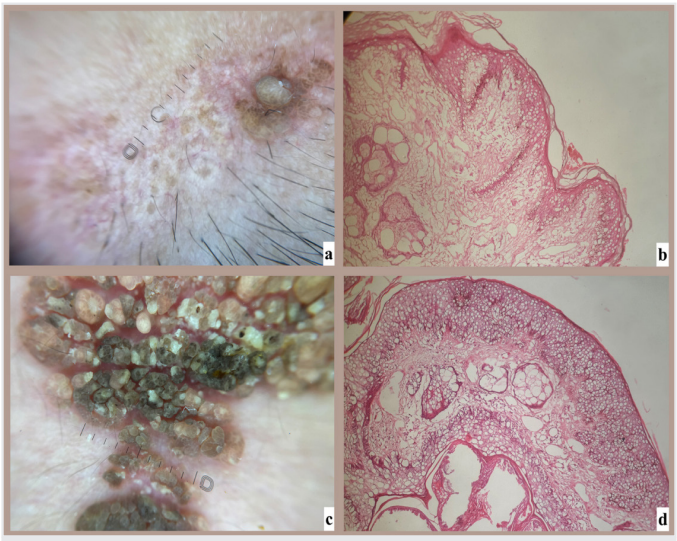

Figure 4. Dermoscopic-histopathological correlation in two representative cases of nevus sebaseus (NS)

(a) Dermoscopic image of a frontal lesion in a 23-year-old male in the early proliferative plaque stage revealing clustered yellowish globules on a pale background with partially preserved follicular openings. (b) Corresponding histopathology showing immature sebaceous lobules, dilated follicular infundibula, and mild acanthosis without papillomatosis, hallmarks of an early stage NS lesion. (c) Dermoscopic image of a neck lesion in a 16-year-old female at the verrucous stage demonstrating cerebriform, yellow-brown lobular structures with overlying whitish scaling, and complete loss of follicular openings. (d) Histological section confirming papillomatous epidermal hyperplasia, sebaceous gland hyperplasia, immature sebaceous units, and pronounced hyperkeratosis, indicative of a fully developed verrucous NS lesion

Statistical Analysis

Analyses were conducted in SPSS v29.0.2 (IBM Corp., Armonk, NY, USA). Continuous variables were reported as mean ± standard deviation and categorical variables as counts and percentages. Group comparisons of continuous variables (e.g., age across stages) used one-way analysis of variance (ANOVA) or independent-samples t-tests, as appropriate. Associations between categorical variables (dermoscopic features versus clinical stages) were examined with Fisher's exact test. Spearman's rank correlation assessed concordance between dermoscopic and histopathological features.

A post-hoc power analysis (G*Power 3.1.9.7) indicated that with n=25 the study had approximately 95% power to detect the strongest observed correlation (r=-0.64), about 73% power for a moderate effect (r≈0.50), and roughly 51% power for a smaller effect (r≈0.40) at two-sided α=0.05; an effect size of r≈0.535 would be required to achieve 80% power under these assumptions. No multiplicity adjustment was applied; therefore, p-values are interpreted cautiously in the context of multiple comparisons. Two-sided $p<0.05$ was considered statistically significant.

Results

Patient Demographics and Clinical Findings

A total of 25 patients (14 males, 11 females; mean age 17.9±11.9 years, range: 3-43) were included. Lesions were most frequently located on the scalp (60.0%), followed by the frontal/frontotemporal region (16.0%), the periauricular/postauricular area (16.0%), and the neck (8.0%). Clinical staging identified 7 patients (28.0%) in the infantile stage, 6 (24.0%) in the early proliferative plaque stage, 8 (32.0%) in the verrucous/late stage, and 4 (16.0%) in the nodular/late stage with neoplastic suspicion. Alopecia was present in over half of the patients, including cases with concomitant alopecia areata (AA). Associated comorbidities such as anxiety disorder, type 1 diabetes mellitus, hyperlipidemia, hypothyroidism, melasma, seborrheic dermatitis, and atopy were documented in several individuals. Detailed demographic and clinical data are summarized in Tables 1 and 2.

Dermoscopic Features

Stage-dependent dermoscopic patterns were observed (Table 3). Yellowish globules were significantly more frequent in early stages (100% vs. 50%, p=0.005), whereas grayish papillary structures were confined to advanced stages (0% vs. 50%, p=0.005). Lobulated yellow structures, fine linear/arborizing vessels, and brown globules tended to be more common in advanced stages; however, these differences did not reach statistical significance ($p>0.05$).

Histopathological Findings and Dermoscopy-histopathology Correlation

Histopathological evaluation was performed in more than half of the cohort. Although biopsy was performed in 15 patients, detailed histopathological data suitable for analysis were available for 13 patients, and these cases were included in the histopathological evaluation. Universal features included acanthosis, hyperkeratosis, basaloid proliferation, sebaceous hyperplasia, absence of terminal follicles, dilated infundibula, and perifollicular inflammation. Variable findings were papillomatosis (76.9%), immature/abortive hair follicles (92.3%), apocrine hyperplasia (30.8%), and eccrine hyperplasia (46.2%). Epidermal cysts and malignant transformation were not observed.

Correlation analysis did not reveal any statistically significant associations between dermoscopic and histopathological features (all $p>0.05$). Immature sebaceous glands were present in all specimens (13/13), precluding correlation analysis for this feature (Table 4).

Table 1. Patient demographics and clinical characteristics (n=25)

Variable	Value (n=25)
Age (mean ± SD, range)	17.9±11.9 years (3-43)
Sex	Male: 14 (56.0%), female: 11 (44.0%)
Lesion site	Scalp: 15 (60.0%); periauricular/postauricular: 4 (16.0%); frontal/frontotemporal: 4 (16.0%); neck: 2 (8.0%)
Clinical stage	Infantile stage (stage 1): 7 (28.0%); early proliferative plaque (stage 2): 6 (24.0%); verrucous/late-stage (stage 3): 8 (32.0%); nodular/late-stage with neoplastic suspicion (stage 4): 4 (16.0%)
Histopathological findings documented	13 (52.0%)
Presence of alopecia	14 (56.0%)
Presence of systemic comorbidities	9 (37.5%) [anxiety disorder (n=2), alopecia areata, type 1 DM, melasma, hyperlipidemia, hypothyroidism, atopy, seborrheic dermatitis]

Note: Values are presented as number (percentage) unless otherwise indicated
SD: Standard deviation, DM: Diabetes mellitus

Discussion

This retrospective study provides an integrated analysis of the clinical, dermoscopic, and histopathological features of 25 patients with NS evaluated over a two-and-a-half-year period. The mean age was 17.9±11.9 years (range: 3-43), with a slight male predominance (56.0%). Lesions were most frequently located on the scalp (60.0%), consistent with previous reports that attribute this predilection to the high density of sebaceous glands and embryological patterning of adnexal structures (17).

Clinical staging demonstrated a distribution across all maturational phases. Infantile lesions were identified in 7 patients (28.0%), early proliferative plaque lesions in 6 patients (24.0%), verrucous/late lesions in 8 patients (32.0%), and nodular/late lesions with early neoplastic suspicion in 4 patients (16.0%). One-way ANOVA confirmed a statistically significant difference in mean age across these stages ($F=3.18$, $p=0.045$), supporting the contribution of chronological age to lesion progression. However, the overlap in age ranges between groups indicates that staging also reflects intrinsic maturational processes, as emphasized in previous clinicopathological and dermoscopic series (18). Although no malignant transformations were detected, advanced-stage cases may represent cumulative proliferative remodeling, underscoring the importance of long-term follow-up in selected patients.

Localized alopecia was observed in more than half of the scalp NS cases, and two patients also had concomitant AA, illustrating the diagnostic challenges in pediatric alopecic plaques. NS can clinically resemble AA, and therefore requires careful differentiation (19). Experimental studies suggest that alopecia in NS may be related to elevated inhibitory cytokines, such as fibroblast growth factor 5, interleukin (IL)-4, IL-6, and DKK-1, which suppress hair growth pathways, including Wnt10b and lymphoid enhancer-binding factor 1 (20).

In our series, 40.0% of the lesions occurred at non-scalp sites, including the frontal, frontotemporal, auricular, and neck regions. These locations may mimic NSH; however, the presence of immature follicles and sebaceous hyperplasia remains distinctive for NS. Recent reports indicate that NSH can be misdiagnosed without histopathological confirmation (21), while early dermoscopic features, such as clustered yellow globules, may assist in differentiation (22). Our findings emphasize that non-scalp NS, although less frequent, requires the same level of diagnostic vigilance as certain lesions may closely mimic NS clinically, reinforcing the importance of histopathological confirmation, particularly in distinguishing it from NSH, epidermal nevus, or other adnexal proliferations in these regions.

Dermoscopy is valuable for staging NS by revealing stage-specific patterns that parallel lesion maturity. Early-stage lesions consistently displayed clustered yellowish globules on a pale background, reflecting immature sebaceous proliferation ($p=0.005$) (18,19). In contrast, advanced lesions were characterized by lobulated yellow structures with cobblestone or cerebriform patterns, brown globules, and more frequent arborizing vessels, although these differences did not reach statistical significance ($p>0.05$) (23,24). Grayish papillary structures were observed exclusively in advanced lesions ($p=0.005$), underscoring their diagnostic relevance (16). Taken together, our findings support the concept that staging reflects intrinsic maturational processes of the lesion rather than chronological age, likely driven by pubertal hormonal influence, RAS/MAPK-mediated sebaceous proliferation, and the local cytokine-inflammatory microenvironment (6,25). Although malignant transformation was not observed in our series, previous reports documented secondary tumors such as sebaceoma with carcinomatous change, poroma, and trichoblastoma arising within NS, highlighting the importance of continued vigilance in advanced stages (26,27).

Table 2. Detailed demographic and clinical characteristics of individual patients

Case	Age	Sex	Localization	Clinical stage	Histopathology	Management (treatment/follow-up)	Associated comorbidities
1	9	M	Periauricular	Verrucous/late-stage NS	Not performed	Follow-up	-
2	37	F	Scalp	Verrucous/late-stage NS with early neoplastic suspicion	Performed	Excisional biopsy	Anxiety disorder
3	19	F	Frontal	Early proliferative plaque stage	Performed	Shave biopsy	Melasma
4	7	M	Scalp	Infantile stage	Not performed	Follow-up	Alopecia areata
5	34	F	Frontotemporal	Verrucous/late-stage NS with early neoplastic suspicion	Performed	Excisional biopsy	Type 1 DM, alopecia areata
6	13	F	Frontal	Verrucous/late-stage NS	Performed	Excisional biopsy	-
7	16	F	Neck	Verrucous/late-stage NS	Performed	Excisional biopsy	-
8	23	M	Frontal	Early proliferative plaque stage	Performed	Excisional biopsy	-
9	14	M	Scalp	Infantile stage	Performed	Excisional biopsy	-
10	10	M	Scalp	Infantile stage	Performed	Punch biopsy	-
11	18	F	Postauricular	Verrucous/late-stage NS	Performed	Shave biopsy	-
12	9	F	Scalp	Infantile stage	Not performed	Follow-up	-
13	43	M	Scalp	Verrucous/late-stage NS with early neoplastic suspicion	Performed	Excisional biopsy	Anxiety disorder
14	18	F	Scalp	Early proliferative plaque stage	Not performed	Follow-up	-
15	9	M	Scalp	Infantile stage	Performed	Excisional biopsy	-
16	41	M	Scalp	Verrucous/late-stage NS	Performed	Excisional biopsy	Hyperlipidemia
17	3	M	Scalp	Infantile stage	Performed	Punch biopsy	-
18	16	M	Scalp	Early proliferative plaque stage	Not performed	Follow-up	-
19	21	M	Scalp	Infantile stage	Not performed	Follow-up	Seborrheic dermatitis
20	10	F	Scalp	Early proliferative plaque stage	Not performed	Follow-up	-
21	11	M	Postauricular	Verrucous/late-stage NS	Not performed	Follow-up	-
22	40	F	Neck	Verrucous/late-stage NS	Performed	Excisional biopsy	Hypothyroidism
23	7	M	Scalp	Early proliferative plaque stage	Not performed	Follow-up	Atopy
24	14	M	Postauricular	Verrucous/late-stage NS	Performed	Shave biopsy	-
25	6	F	Scalp	Early proliferative plaque stage	Not performed	Follow-up	-

Note: Table presents individual patient-level data including age, sex, lesion localization, clinical stage, histopathological status, management, and associated comorbidities
NS: Nevus sebaceus, DM: Diabetes mellitus

Table 3. Association between dermoscopic features and clinical stages of nevus sebaceus (n=25)

Dermoscopic feature	Early stages (1-2) (n=13)	Advanced stages (3-4) (n=12)	Fisher's exact test (p-value)
Yellowish globules	13/13 (100.0%)	6/12 (50.0%)	**0.005**
Lobulated yellow structures	8/13 (61.5%)	10/12 (83.3%)	0.378
Fine linear/arborizing vessels	4/13 (30.8%)	8/12 (66.7%)	0.115
Grayish papillary structures	0/13 (0.0%)	6/12 (50.0%)	**0.005**
Brown globules	4/13 (30.8%)	8/12 (66.7%)	0.115

Note: Frequencies were compared between early-stage (stages 1-2, n=13) and advanced-stage (stages 3-4, n=12) lesions using two-sided Fisher's exact test. P<0.05 was considered statistically significant

Table 4. Variable histopathological features in nevus sebaceus and their dermoscopic associations (n=13 biopsy cases)

Histopathological feature	Frequency n (%)	Dermoscopic association	Spearman r	p-value	Comment
Papillomatosis	10 (76.9)	Yellowish globules	0.43	0.147	NS
Immature/abortive HF	12 (92.3)	Yellowish globules	0.43	0.139	NS
Apocrine hyperplasia	4 (30.8)	Grayish papillary structures	-0.08	0.787	NS
Eccrine hyperplasia	6 (46.2)	Lobulated yellow structures	-0.46	0.113	Negative trend, NS
Immature sebaceous glands	13 (100)	Lobulated yellow structures	NA	NA	All cases positive

Note: Universal histopathological features present in all analyzed specimens were omitted from the table. Spearman correlation coefficients are two-sided
NS: Not significant, HF: Hair follicle, NA: Not applicable

Histopathological evaluation in our cohort showed consistent features of NS—acanthosis, basaloid proliferation, hyperkeratosis, immature sebaceous glands with sebaceous hyperplasia, dilated infundibula, absence of terminal follicles, and perifollicular inflammation—findings that were nearly universal and concordant with large series (28). The lack of normal terminal follicles relative to adjacent skin is a practical diagnostic clue, while the presence of mature sebaceous lobules arranged around a dilated duct underscores the hamartomatous nature of NS rather than simple sebaceous hyperplasia (29). Consistent with a recent study of 60 cases by Karimian et al. (30), our histopathological evaluation confirmed papillomatosis (76.9%), immature/abortive hair follicles (92.3%), and apocrine hyperplasia (30.8%) as frequent features of NS.

While we also observed eccrine hyperplasia (46.2%), no malignant transformation was detected in our series. Although correlation analysis did not reveal statistically significant dermoscopy-histopathology associations, this was likely related to the intrinsic heterogeneity of NS and maturational variation within different regions of the same lesion, which produces stage-dependent dermoscopic appearances rather than direct microscopic counterparts, as well as the limited number of biopsied lesions, which may have reduced statistical power. Reported malignant risk remains variable, with some series noting higher rates in older patients (31,32), whereas others advocate individualized, risk-adapted management (33).

The cobblestone or cerebriform brown globules observed in advanced lesions likely reflect underlying epidermal remodeling and papillomatosis, consistent with prior case-based correlations (16).

In our cohort, most patients (60%) underwent surgical procedures for diagnostic or therapeutic purposes, predominantly in adult cases, reflecting our institutional tendency to prioritize operative management in this age group. While no malignant transformations were observed, surgical removal was considered the preferred approach for lesions showing progressive morphological changes or occurring in adulthood. Histopathological evaluation should ideally include multipoint sampling, as NS may harbor heterogeneous adnexal proliferations, especially in longstanding lesions (26,27). The literature on NS management remains divided: observation in children with excision deferred to adulthood has been suggested, and large pediatric cohorts have reported no malignancy, supporting conservative monitoring (34). Universal excision has also been recommended (35), whereas a large metaanalysis emphasized individualized, riskadapted strategies (33). Imagingassisted decisionmaking with dermoscopy and, when available, reflectance confocal microscopy has been proposed (23,24), and surveys have further highlighted variability between dermatologists and surgeons regarding the timing of excision (36). Prophylactic excision is also supported by narrative reviews (28).

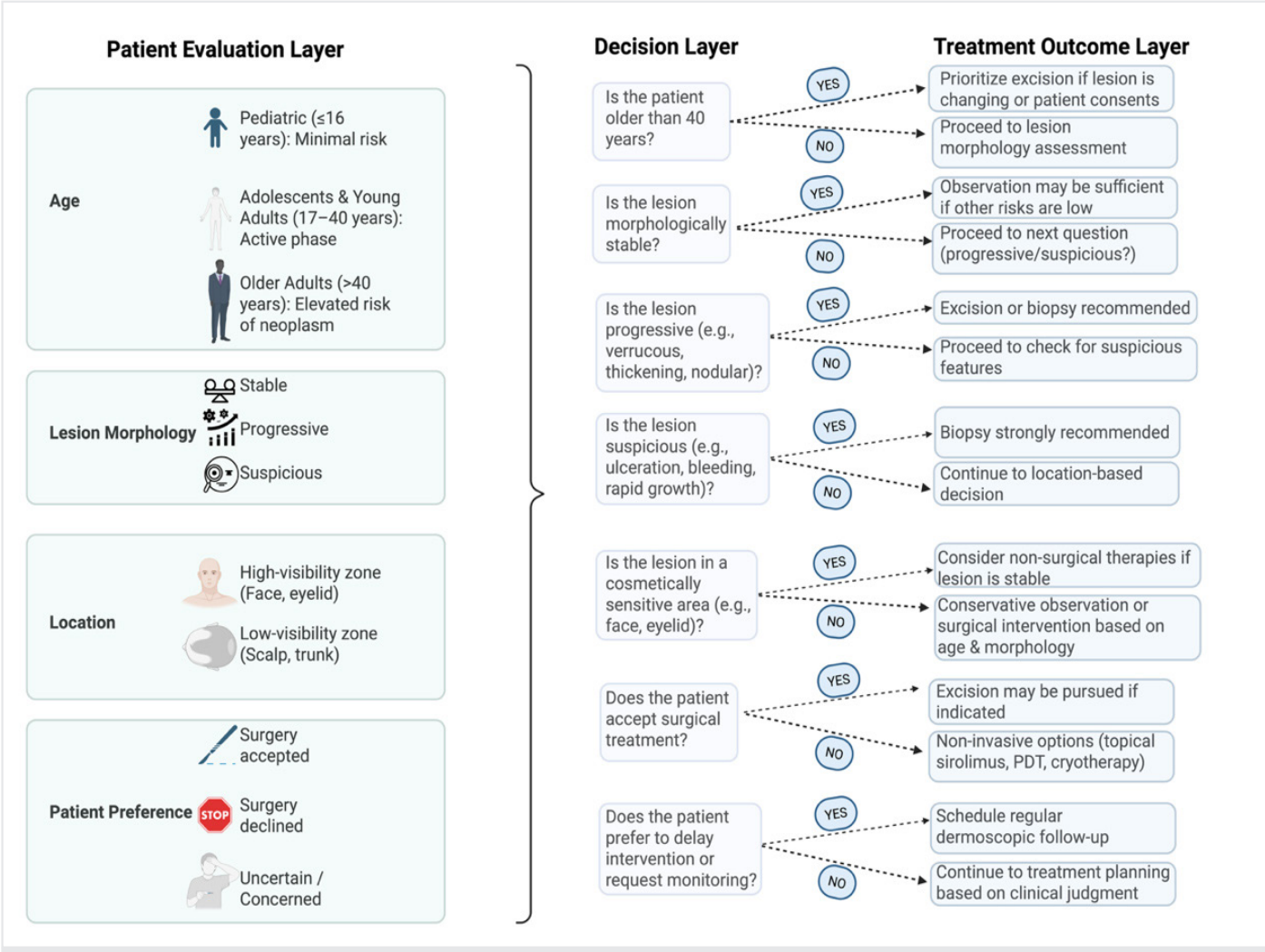

Figure 5. Individualized management flowchart for nevus sebaceus (NS)

This three-tiered clinical decision model integrates patient-specific variables (age, lesion morphology, location, and preference), guiding personalized treatment strategies for NS. The decision layer consists of sequential clinical questions leading to evidence-based management options. Final outcomes include surgical excision, observation, or non-invasive therapies (e.g., topical sirolimus, photodynamic therapy, cryotherapy). The algorithm emphasizes shared decision-making, cosmetic considerations, and malignancy risk stratification across life stages.

PDT: Photodynamic therapy

Non-surgical approaches, including topical sirolimus (37), photodynamic therapy (38), carbondioxide laser ablation (39-42), and cryotherapy (43,44), have been reported, although longterm efficacy remains uncertain. Overall, our findings support selective follow-up for stable lesions, with surgery prioritized in advanced or clinically suspicious cases. This approach is captured in our management algorithm (Figure 5), which integrates patient age, lesion morphology, and treatment preference and is contextualized within the range of strategies summarized in Table 5.

Study Limitations

The retrospective nature of this study and the short follow-up period may limit the evaluation of the long-term outcomes and generalizability. Further prospective studies incorporating molecular analyses and comparative treatment groups along with extended follow-up would provide deeper insights and validate our findings.

Table 5. Management strategies for nevus sebaceus: literature-based comparative overview

Author(s)	Patient population/ sample size	Primary recommendation	Key rationale	Alternative approaches
Santibanez-Gallerani et al. (34)	757 pediatric patients	Excision not necessary	No malignancy found; age-related risk emphasized	Regular monitoring
Rosen et al. (35)	631 patients (651 NS lesions)	Universal excision	BCC observed in 0.8% of patients, including children; no clinical predictors; premalignant lesions in 1.1%	Flexible timing; shared decision-making encouraged
Pang et al. (33)	Meta-analysis of 6005 cases	Risk-stratified, individualized approach	2.4% malignant transformation; 1.7% BCC; 10.3% benign tumors	Excision or observation depending on case specifics
Zaballos et al. (24)	58 lesions with histology + dermoscopy	Imaging-assisted decision-making	Challenging dermoscopic distinction between BCC and TB	Confocal microscopy, selective biopsy
Wali et al. (36)	National survey (UK dermatologists & surgeons)	Expert opinion divided	90% of surgeons vs. 30% of dermatologists recommend excision	Majority of dermatologists favor clinical follow-up
Neto et al. (1)	Narrative review	Prophylactic excision favored	Cosmetic concerns, secondary neoplasm potential, trauma-induced changes	Laser ablation, dermabrasion, PDT
Zhou and Antaya (37)	5 cases with clinically confirmed NS	Topical sirolimus	Significant lesion flattening; minimal side effects	Non-invasive topical therapy
Moreno-Arrones and Perez-Garcia (38)	6 patients with facial NS	PDT	Up to 80% lesion reduction; long-term stability; no recurrence	Surgery deferred; good cosmetic outcome
Kim et al. (39); Sutedja et al. (40); Dartaha and Jobran (41); Gaydina et al. (42)	5 young patients (ages 10-30)	CO_2 laser ablation (± isotretinoin)	Effective for small-to-moderate lesions, including facial and atypical locations; cosmetically favorable; no short-term recurrence; requires long-term follow-up	Full-thickness excision; close observation for recurrence or secondary neoplasia
Alqahtani and Al-Natour (43); Handler and Schwartz (44)	16-year-old patient with trichilemmoma; literature-based technical protocol	Cryotherapy	Cosmetically favorable for patients declining surgery; recommended for superficial lesions; effective with proper freeze technique	Full-thickness excision; laser ablation; clinical follow-up for recurrence
Kaya et al. (present study)	25 patients; 10 followed non-invasively	Selective follow-up appropriate	No malignant transformation observed; short-term stability in conservatively managed lesions	Dermoscopic surveillance; biopsy if clinical change

Note: Summary of literature-based management approaches for nevus sebaceus
PDT: Photodynamic therapy, BCC: Basal cell carcinoma, TB: Trichoblastoma, NS: Nevus sebaceus

Conclusion

Although no statistically significant dermoscopic-histopathological associations were identified, our study demonstrated that dermoscopy provided robust, stage-dependent diagnostic insights in NS. These findings emphasize that dermoscopic patterns mirror the biological evolution of the lesion, supporting its use as a non-invasive tool for risk stratification and follow-up. The absence of malignant transformation in this cohort is consistent with the indolent nature of NS, yet long-term vigilance remains warranted. Conservative surveillance may be justified in selected cases, but surgical excision continues to represent the standard approach for advanced or clinically suspicious lesions.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Scientific Research Ethics Committee of the affiliated Bezmialem Vakıf University (approval no: E-54022451-050.04-194650, decision no: 2025/185, date: 24.05.2025).

Informed Consent: This retrospective observational study was conducted at Nizip State Hospital, a public secondary care center in Gaziantep, Türkiye, over a 2.5-year period (2023-2025).

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Throughout the course of this study, we adhered strictly to the World Medical Association Declaration of Helsinki and the Good Clinical and Laboratory Practice standards. All figures were created using BioRender.com under an academic license for scientific communication purposes.

Footnotes

Authorship Contributions

Surgical and Medical Practices: G.K., M.Ö.G., Concept: G.K., M.Ö.G., C.A., A.Y.T., Design: G.K., C.A., A.Y.T., Data Collection or Processing: G.K., Analysis or Interpretation: G.K., M.Ö.G., A.Y.T., Literature Search: G.K., M.Ö.G., Writing: G.K., C.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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Data Availability Statement

The datasets analyzed during the current study are not publicly available due to institutional data protection policies, but are available from the corresponding author upon reasonable request.

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