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Do Dermatoses Trigger Neurodegenerative Diseases? A Retrospective Observational Study

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Abstract

Background and Objective: Neurological diseases, in addition to their systemic effects, may also lead to various dermatological manifestations. In this study, the distribution of dermatological findings in patients diagnosed with Parkinson's disease (PD), Multiple Sclerosis (MS), and Amyotrophic Lateral Sclerosis (ALS) was examined, and intergroup differences were evaluated.

Methods: This retrospective study included a total of 848 patients who were followed in the neurology outpatient clinic and underwent dermatological evaluation. Patients were categorized into PD (n=347), MS (n=401), and ALS (n=100) groups. The presence of 21 dermatological findings was assessed in each patient, and the data were analyzed using the Jamovi statistical software. Chi-square test was used for intergroup comparisons, and McNemar's test was used for pairwise comparisons.

Results: The most frequently observed dermatological findings were fungal infections (11.9%), xerosis (11.0%), eczematous dermatitis (8.6%), and seborrheic dermatitis (4.7%). High-prevalence findings such as fungal infections, xerosis, eczematous dermatitis, and seborrheic dermatitis were significantly more common compared to lower-prevalence findings ($p<0.001$). Additionally, xerosis was found to be more frequent in Parkinson's patients ($p=0.001$).

Conclusion: The frequent observation of fungal infections in these patient groups is notable, especially in light of recent studies suggesting that fungal infections may trigger neurodegenerative diseases. Besides fungal infections, the presence of other skin findings highlights the necessity of including dermatological evaluations in the follow-up of these patient groups. Although fungal infections were more frequently observed in patients with neurodegenerative diseases—particularly Parkinson's disease—this difference did not reach statistical significance. However, the trend observed aligns with growing evidence linking fungal organisms to neuroinflammatory mechanisms

Keywords: PD, MS, ALS, Fungal infection

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Dermatozlar Nörodejeneratif Hastalıkları Tetikler mi?: Retrospektif Gözlemsel Çalışma

Öz

Arka Plan ve Amaç: Nörolojik hastalıklar sistemik etkilerinin yanı sıra ciltte çeşitli dermatolojik bulgulara da neden olabilmektedir. Bu çalışmada, Parkinson hastalığı (PD), Multipl Skleroz (MS) ve Amiyotrofik Lateral Skleroz (ALS) tanılı hastalarda dermatolojik bulguların dağılımı incelenmiş ve gruplar arası farklılıklar değerlendirilmiştir.

Yöntemler: Bu retrospektif çalışmaya, nöroloji polikliniğinde takip edilen ve dermatolojik değerlendirmesi yapılan toplam 848 hasta dahil edilmiştir. Hastalar PD (n=347), MS (n=401) ve ALS (n=100) gruplarına ayrılmıştır. Her hastada 21 dermatolojik bulgunun varlığı incelenmiş ve veriler Jamovi istatistik programı ile analiz edilmiştir. Gruplar arası karşılaştırmalarda ki-kare testi, ikili karşılaştırmalarda McNemar testi kullanılmıştır.

Bulgular: En sık gözlenen dermatolojik bulgular mantar enfeksiyonu (%11.9), kseroz (%11.0), egzematöz dermatit (%8.6) ve seboreik dermatit (%4.7) olarak tespit edilmiştir. Mantar enfeksiyonları, kseroz egzematöz dermatit ve seboreik dermatit gibi yüksek prevalanslı bulgular, diğer düşük prevalanslı bulgularla karşılaştırıldığında anlamlı olarak daha sık izlenmiştir ($p<0.001$). Ayrıca kserozun Parkinson hastalarında daha sık görüldüğü belirlenmiştir ($p=0.001$).

Sonuç: Mantar enfeksiyonlarının bu hasta gruplarında sık gözlemlenmesi ve son yıllarda yapılan çalışmalarda mantar enfeksiyonlarının nörodejeneratif hastalıkları tetikleyebileceğine dair izlenimler dolayısıyla önemlidir. Mantar dışında diğer cilt bulgularının da varlığı bu hasta gruplarının takibinde dermatolojinin de bulunmasının gerekliliğini vurgular.

Anahtar kelimeler: PD,MS,ALS,Mantar enfeksiyonu.

INTRODUCTION

Neurological diseases can affect not only the nervous system but also the neural crest cells in the skin, potentially leading to various dermatological problems. The presence of conditions such as xerosis and seborrheic dermatitis in Parkinson's disease, and sclerotic skin reactions in patients with multiple sclerosis, supports the notion that the nervous system and dermatological system are interrelated[1–3]. There is also literature suggesting that certain skin infections—particularly fungal infections—may trigger or co-occur with neurodegenerative diseases[4,5]. In this study, we aim to investigate dermatological findings observed in patients with Parkinson's disease, multiple sclerosis, and amyotrophic lateral sclerosis.

METHOD

This retrospective study was conducted at Training and Research Hospital. Ethical approval was obtained from the relevant ethics committee (2025/444) and the study was conducted in accordance with the Declaration of Helsinki. A total of 848 patients who were followed in the neurology outpatient clinic and also evaluated in the dermatology clinic between the years 2020 and 2024 were included in the study. Patients included in the study were those aged 18 years or older with a neurologist-confirmed diagnosis of Parkinson's disease (PD), Multiple Sclerosis (MS), or Amyotrophic Lateral Sclerosis (ALS), who had dermatological examination or consultation notes available in hospital records, and whose demographic and clinical data were complete. Patients were excluded if they did not have a confirmed diagnosis of a neurodegenerative disease, were younger than 18 years of age, had incomplete or insufficient medical records, or if their dermatological findings were determined to be secondary to systemic diseases or medications Patients were categorized into three groups based on their diagnoses: PD (n=347), MS (n=401), and ALS (n=100). In addition to demographic data such as age and gender, dermatological examination findings were also assessed. The presence or absence of

a total of 21 dermatological findings was coded in binary form (0: absent, 1: present) for each patient. These findings included seborrheic dermatitis, eczema, tinea, xerosis, calluses, telogen effluvium, scabies, pemphigus, rosacea, alopecia areata, viral warts, psoriasis, basal cell carcinoma (BCC), oral aphthae, urticaria, hidradenitis, erythema multiforme, pyogenic granuloma, and others.

Statistical Analysis

Statistical analyses were performed using the JAMOVI software. Descriptive statistics were presented as mean, standard deviation, and median values for continuous variables. Categorical variables were expressed as frequencies and percentages (%). The chi-square test was used to evaluate the distribution of dermatological findings across neurological disease groups. For pairwise comparisons, the McNemar test was employed. A p-value of <0.05 was considered statistically significant for intergroup comparisons. Differences between the most frequently observed dermatological findings and those observed less frequently were also assessed through pairwise analyses. The resulting p-values were presented and interpreted in tabular form.

RESULTS

Comparison by Neurological Diseases

Among the 848 patients included in the study, The mean age of patients with Parkinson's disease was 65.1 ± 12.9 years, for MS patients it was 38.2 ± 12.0 years, and for ALS patients it was 49.5 ± 16.5 years. The Parkinson's group included 204 men (24.1%) and 143 women (16.9%), the MS group included 118 men (13.9%) and 283 women (33.4%), and the ALS group included 56 men (6.6%) and 44 women (5.2%) fungal infections were detected in 11.9% (n=101) of the cases. Fungal infections were observed in 14.7% (n=51) of Parkinson's patients, 10.7% (n=43) of MS patients, and 7.0% (n=7) of ALS patients. There was no statistically significant difference in the frequency of fungal infections based on the type of neurological disease (p=0.067). Xerosis was observed in 11.0% (n=93) of the patients—15.6% (n=54) of Parkinson's patients, 7.2% (n=29) of MS patients, and 10.0% (n=10) of ALS patients. A statistically significant difference in the frequency of xerosis was observed across neurological disease types (p=0.001). Eczema was found in 8.6% (n=73) of the patients. Eczematous dermatitis was observed in 10.7% (n=37) of Parkinson's patients, 6.5% (n=26) of MS patients, and 10.0% (n=10) of ALS patients. No statistically significant difference was found in the frequency of eczematous dermatitis by neurological disease type (p=0.110). Seborrheic dermatitis was identified in 4.7% (n=40) of patients. It was observed in 4.6% (n=16) of Parkinson's patients, 5.0% (n=20) of MS patients, and 4.0% (n=4) of ALS patients. There was no statistically significant difference in the frequency of seborrheic dermatitis among the different neurological disease groups (p=0.910). Other dermatological findings, all of which are listed in Table 1.

Table I: Distribution of dermatological findings by neurological diseases

Dermatological Condition	Total (%) [n]	Parkinson (%)	MS (%)	ALS (%)	p-value
Fungal infections	11.9 (n=101)	14.7 (n=51)	10.7 (n=43)	7.0 (n=7)	0.067
Xerosis	11.0 (n=93)	15.6 (n=54)	7.2 (n=29)	10.0 (n=10)	0.001
Eczematous dermatitis	8.6 (n=73)	10.7 (n=37)	6.5 (n=26)	10.0 (n=10)	0.110
Seborrheic dermatitis	4.7 (n=40)	4.6 (n=16)	5.0 (n=20)	4.0 (n=4)	0.910
Viral wart	2.5 (n=21)	2.0 (n=7)	3.5 (n=14)	0.0 (n=0)	0.103
Callus	2.0 (n=17)	2.9 (n=10)	1.7 (n=7)	0.0 (n=0)	0.170
Chronic spontaneous urticaria	1.4 (n=12)	1.2 (n=4)	2.0 (n=8)	0.0 (n=0)	0.276
Herpes zoster	1.3 (n=11)	1.4 (n=5)	1.5 (n=6)	0.0 (n=0)	0.474
Scabies	1.2 (n=10)	1.4 (n=5)	0.7 (n=3)	2.0 (n=2)	0.491
Telogen effluvium	1.2 (n=10)	0.3 (n=1)	2.2 (n=9)	0.0 (n=0)	0.024
Cellulitis	0.9 (n=8)	2.0 (n=7)	0.0 (n=0)	1.0 (n=1)	0.017
Psoriasis	0.9 (n=8)	0.6 (n=2)	1.2 (n=5)	1.0 (n=1)	0.638
Alopecia areata	0.7 (n=6)	0.6 (n=2)	1.0 (n=4)	0.0 (n=0)	0.528
Oral aphthae	0.6 (n=5)	0.9 (n=3)	0.5 (n=2)	0.0 (n=0)	0.578
Actinic keratosis	0.6 (n=5)	0.9 (n=3)	0.2 (n=1)	1.0 (n=1)	0.466
Rosacea	0.5 (n=4)	0.6 (n=2)	0.5 (n=2)	0.0 (n=0)	0.755
Atopic dermatitis	0.2 (n=2)	0.3 (n=1)	0.2 (n=1)	0.0 (n=0)	0.869
Basal cell carcinoma	0.2 (n=2)	0.6 (n=2)	0.0 (n=0)	0.0 (n=0)	0.235
Bullous pemphigoid	0.2 (n=2)	0.6 (n=2)	0.0 (n=0)	0.0 (n=0)	0.235
Erythema multiforme	0.2 (n=2)	0.3 (n=1)	0.0 (n=0)	1.0 (n=1)	0.176
Pyogenic granuloma	0.1 (n=1)	0.3 (n=1)	0.0 (n=0)	0.0 (n=0)	0.485
Hidradenitis suppurativa	0.1 (n=1)	0.0 (n=0)	0.2 (n=1)	0.0 (n=0)	0.572

Intra-Comparison of Dermatological Findings

Among all neurological diseases, tinea infections were the most frequently observed dermatological finding, seen in 11.9% (n=101) of patients. When compared to eczematous dermatitis, a statistically significant difference was observed (p=0.020), whereas no significant difference was found when compared to xerosis (p=0.511). However, significant differences were found when compared to other dermatological conditions (p<0.001) (Table 2).

Table II: Comparison of fungal ınfections with other dermatological conditions

Comparison	p-value
Fungal infections vs Eczematous dermatitis	0.020
Fungal infections vs Xerosis	0.511
Fungal infections vs Other low prevalence conditions	<0.001

Eczematous dermatitis was observed in 8.6% (n=73) of patients across neurological diseases and showed statistically significant differences when compared with tinea, xerosis, and other dermatological conditions (p=0.020, p=0.029, p<0.001) (Table 3).

Table III: Comparison of eczematous dermatitis with other dermatological conditions

Comparison	p-value
Eczematous dermatitis vs Fungal infections	0.020
Eczematous dermatitis vs Xerosis	0.029
Eczematous dermatitis vs Other low prevalence conditions	<0.001

Seborrheic dermatitis was observed in 4.7% (n=40) of patients across neurological diseases. It was found at a significantly higher rate compared to calluses, viral warts, and other less frequently observed dermatological conditions (p=0.002, p=0.010, p<0.001) (Table 4).

Table IV: Comparison of seborrheic dermatitis with other dermatological conditions

Comparison	p-value
Seborrheic Dermatitis vs Callus	0.002
Seborrheic Dermatitis vs Viral Wart	0.010
Seborrheic Dermatitis vs Other low prevalence conditions	<0.001

DISCUSSION

In this study, dermatological findings observed in individuals with neurological diseases such as PD, MS, and ALS were examined. The significantly higher prevalence of fungal infections, xerosis, eczematous dermatitis, and seborrheic dermatitis compared to other findings among individuals with neurological conditions suggests that routine dermatological examinations and appropriate treatments in these patient groups could contribute to improved quality of life. Neurological diseases can affect not only the nervous system but also neural crest cells in the skin, leading to certain dermatological problems[1-3]. In our study, tinea infections were the most commonly observed condition. There is evidence suggesting a role of tinea, particularly in the etiology of MS. One study highlighted the connection between fungal infections and several markers of MS such as IL-17 and chitotriosidase. Moreover, the fact that dimethyfumarate—a compound used as an industrial antifungal agent—can alleviate MS symptoms further strengthens this link[4-5]. Additionally, one MS patient was followed for three years, during which antibodies against Candida species were detected in peripheral blood serum[6]. In another study comparing the fungal microbiome of 25 MS patients to healthy controls, higher levels of Candida and Saccharomyces were observed in the MS group, raising questions about the role of fungal infections in MS etiology[7].A systematic review published in recent years also suggested that fungal infections in the body could stimulate immune responses and potentially trigger non-communicable neurological disorders such as MS, PD, and ALS[5]. Furthermore, some studies indicate that fungal infections may also play a role in Parkinson's disease. In a study involving CNS tissue samples from 66 PD patients, fungal species such as Candida and Malassezia were isolated, suggesting a possible contribution to the etiopathogenesis of PD[8]. A recent systematic study also suggested that an increased risk of Parkinson's disease may be associated with infections caused by Malassezia species, although not as a sole factor, but rather in conjunction with other bacterial and viral agents[9]. Another study indicated that Malassezia may act as a risk factor in the etiology of Parkinson's, as seborrheic dermatitis is more frequently observed in Parkinson's patients. Additionally, individuals with rosacea are considered at higher risk for early-onset Parkinson's disease[10]. It is well-known that dopamine reduction plays a critical role in the clinical presentation of PD, and Malassezia may potentially influence melanin production, which is a precursor of dopamine[11]. There are also studies in the literature suggesting that fungal infections might play a role in the pathogenesis of ALS. In one study examining brain tissue sections from 11 ALS patients, immunopositive staining for Candida and Penicillium was observed[12]. Another study proposed that fungal neurotoxins could potentially contribute to the development of sporadic ALS[13]. Seborrheic dermatitis, a skin disease whose etiology has been linked to fungal infections, is also frequently seen in patients with Parkinson's disease. One study showed that seborrheic dermatitis could be associated with motor function disorders in PD[14]. A recent study on patients with seborrheic dermatitis reported a high incidence of seborrheic dermatitis in individuals with Parkinson's disease. Interestingly, in this study, seborrheic dermatitis was observed less frequently in PD patients with predominant motor dysfunction

compared to those with predominant autonomic dysfunction. This finding emphasizes that non-motor symptoms, including cutaneous signs, may be among the earliest manifestations of PD, underlining the importance of dermatological involvement in the follow-up of Parkinson's patients[15]. There is no direct evidence showing that seborrheic dermatitis is observed in MS and ALS patients. However, the presence of Malassezia—a microorganism considered a contributing factor in the etiology of seborrheic dermatitis—has been detected in studies involving these patient groups[12,16]. This may explain the increased incidence of seborrheic dermatitis in such patients, as our study also observed similar rates of seborrheic dermatitis across the groups. Furthermore, a study suggesting that cutaneous symptoms may appear before motor symptoms[15] reinforces the idea that neurodegenerative diseases may be triggered by skin conditions, or that dermatological conditions may co-occur with neurodegenerative disorders. This highlights the importance of dermatological monitoring in these patient populations. A recent study examining 215 Parkinson's patients found xerosis in 16% of them, associating it with early-stage PD. Similarly, in our study, approximately 15% of patients showed signs of xerosis, supporting this finding[2]. There is also literature suggesting an increase in dry skin among ALS patients, providing another example of how neurodegenerative diseases may trigger cutaneous symptoms[17]. Rosacea, while not significantly elevated, was also observed in both MS and PD patient groups. Given the studies linking rosacea to early-stage Parkinson's disease, this finding is noteworthy[18–20]. A meta-analysis also indicated that the risk of basal cell carcinoma (BCC) may be higher in PD patients compared to other skin cancers. In our study, two PD patients were diagnosed with BCC, further underlining the importance of regular dermatological examinations for this patient group[21]. Some studies have also highlighted that bullous pemphigoid may increase the risk of Parkinson's disease by up to threefold. While not significantly elevated in our study, bullous pemphigoid was observed in two cases[22–24]. Although not statistically significant, urticaria was more frequently observed in MS patients compared to other neurological groups. A study involving patients with chronic spontaneous urticaria also found an increased risk of MS, providing strong support for this association[25].

Your initial statement notes that although eczematous dermatitis is frequently observed in neurological diseases, there is no direct study establishing a link between the two However, there are limited studies on atopic dermatitis in Parkinson's patients, and in their experience, they only encountered atopic dermatitis in 2 cases. They suggest that the frequent occurrence of eczematous dermatitis in these patients might be due to increased dry skin, which could trigger eczematous dermatitis[26,27].

CONCLUSIONS

Our study observed a high incidence of fungal infections in neurodegenerative diseases. Recent studies in the literature also suggest that this condition may trigger neurodegenerative diseases. However, the retrospective nature of our study and the inability to clearly determine which fungal species caused the infection, as well as whether the fungal infections developed before or after the disease, are limiting factors of our study. Nevertheless, the recent publication of new literature supporting our findings makes our work significant. Furthermore, the observation of various skin findings other than tinea in these patients indicates the importance of dermatology and a multidisciplinary approach in the follow-up of these patients.

Ethics Committee Approval: Ethical approval for this study was obtained from the Health Sciences University Training and Research Hospital

(2025/444). The study was conducted in accordance with the Declaration of Helsinki. Written and verbal consent was obtained from the patients.

Conflict of Interest: The authors declared no conflicts of interest.

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