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Original Research Article

Cutaneous Manifestations of Respiratory Diseases

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Abstract:

Background: Cutaneous manifestations often accompany respiratory diseases, reflecting systemic involvement. These skin signs can provide vital clues for early diagnosis and management of pulmonary disorders.

Objective: This study aims to evaluate the prevalence and nature of cutaneous manifestations in patients with respiratory diseases at Hamdard Institute of Medical Sciences and Research, India.

Method: A cross-sectional study was conducted from April 2023 to August 2024, involving 110 patients diagnosed with various respiratory diseases. Detailed dermatological examinations were performed, and findings were correlated with clinical, radiological, and histopathological data. Statistical analysis was conducted to determine the relationship between cutaneous manifestations and respiratory diseases.

Result: Out of 110 patients, 45% presented with cutaneous manifestations. The most common skin presentations included eczema (25%), erythema nodosum (10%), and digital clubbing (5%). Among patients with chronic obstructive pulmonary disease (COPD), 40% had associated skin conditions. In patients with sarcoidosis, 60% exhibited cutaneous signs, primarily erythema nodosum. In lung cancer patients, paraneoplastic skin conditions, including dermatomyositis, were seen in 15%. A significant correlation was found between the severity of respiratory diseases and the extent of skin involvement ($p < 0.05$). Early recognition of these dermatologic findings aided in timely diagnosis and improved clinical outcomes.

Conclusion: Cutaneous manifestations are frequent in respiratory diseases, offering critical diagnostic and prognostic value. Clinicians should integrate dermatologic evaluations into routine respiratory disease management to enhance patient care.

Keywords: Cutaneous Manifestations, Respiratory Diseases, COPD, Sarcoidosis, Dermatomyositis.

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Introduction

The skin, as the largest organ in the human body, often mirrors the internal health of an individual, acting as a window to various systemic conditions [1]. One such category where this connection becomes evident is respiratory diseases, where cutaneous manifestations frequently accompany or even precede the diagnosis of a pulmonary disorder. The correlation between skin manifestations and respiratory diseases is an evolving field of study, shedding light on how pulmonary pathologies, ranging from infections and malignancies to autoimmune conditions, can present with dermatologic symptoms. These cutaneous manifestations may vary in presentation, from subtle rashes to more severe necrotizing lesions, providing clinicians with critical clues regarding the underlying respiratory disease. Since skin conditions are often more apparent and accessible for clinical examination, recognizing these signs can facilitate the early detection and management of respiratory conditions.

Understanding the cutaneous manifestations of respiratory diseases requires a multidisciplinary approach, incorporating dermatology, pulmonology, and internal medicine. Studies suggest that the pathophysiological processes underlying many respiratory diseases, such as chronic inflammation, hypoxia, or autoimmunity, can influence the skin [2]. This interaction is not limited to specific respiratory conditions but spans a wide spectrum, including chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and infectious diseases like tuberculosis. In addition, systemic inflammatory disorders, such as sarcoidosis, and autoimmune conditions, such as lupus erythematosus, have notable pulmonary and dermatologic involvement, emphasizing the importance of a comprehensive diagnostic approach

[3]. Cutaneous manifestations are often an early sign of diseases that primarily affect the lungs. For instance, in sarcoidosis, a multisystem granulomatous disease, cutaneous involvement is seen in approximately 25% of patients and can present as erythema nodosum, lupus pernio, or plaques [4]. The appearance of such lesions often predates pulmonary involvement, thus acting as an important early diagnostic clue. In contrast, diseases like tuberculosis can manifest with cutaneous signs such as erythema induratum, lupus vulgaris, or tuberculids, which arise from either direct skin infection or immune-mediated processes [5].

Infections of the respiratory tract, particularly those of a chronic or recurrent nature, are another category where cutaneous manifestations are common. For instance, individuals with bacterial pneumonia, bronchiectasis, or cystic fibrosis may develop skin conditions such as pyoderma gangrenosum or necrotizing cutaneous infections. Moreover, viral infections affecting the respiratory tract, such as herpes zoster, can present with characteristic skin lesions, often as painful vesicular eruptions along dermatomes [6]. These manifestations are not merely coincidental but often result from the direct effects of the infectious agent, immunosuppression, or secondary complications arising from chronic disease. Autoimmune disorders provide another compelling link between the skin and the respiratory system. Lupus erythematosus, for example, can cause both pulmonary fibrosis and a range of cutaneous manifestations, including classic malar rash, discoid lupus, and subacute cutaneous lupus erythematosus. These skin conditions often correlate with the severity of systemic involvement, including pulmonary symptoms, and may guide therapeutic decision-making [7]. Similarly, systemic sclerosis, an autoimmune condition characterized by skin thickening and fibrosis, often involves the lungs, leading to interstitial lung disease or pulmonary hypertension [8]. In both cases, the skin manifestations can serve as a hallmark of disease activity, highlighting the intricate connection between these two organ systems.

In malignancies, particularly lung cancer, paraneoplastic syndromes may manifest with a range of cutaneous findings. Dermatomyositis, a rare inflammatory disease affecting the muscles and skin, is strongly associated with malignancy, particularly lung cancer, in middle-aged and older individuals [9]. Patients may present with characteristic skin findings such as the heliotrope rash or Gottron's papules, which often precede the diagnosis of an underlying malignancy. The recognition of such paraneoplastic skin conditions is crucial, as they often provide the first clinical hint of an occult malignancy. Chronic inflammatory conditions, such as COPD, are also known to have associated skin manifestations. Studies have shown that individuals with COPD are at increased risk for developing skin conditions like eczema, psoriasis, and chronic urticaria, which are believed to result from systemic inflammation, hypoxia, and the impaired immune function that accompanies chronic respiratory disease [10]. Similarly, chronic hypoxia, which characterizes many advanced respiratory diseases, can lead to cyanosis and digital clubbing, both of which are visible on physical examination and may provide early clues to underlying pulmonary pathology.

The clinical significance of recognizing cutaneous manifestations of respiratory diseases lies in their potential to aid early diagnosis and improve patient outcomes. Dermatologic findings can sometimes be the most apparent and easily accessible sign of systemic disease, particularly in conditions where respiratory symptoms may be subtle or nonspecific in the early stages. By fostering collaboration between dermatologists, pulmonologists, and other healthcare providers, early identification and intervention can be achieved, potentially improving the prognosis for individuals with respiratory diseases [11]. As research continues to uncover the complex interactions between the skin and the respiratory system, clinicians are increasingly equipped with the tools and knowledge to make timely diagnoses and deliver more effective treatments.

Aims and Objective: The aim of this study is to investigate the prevalence and characteristics of cutaneous manifestations in patients with respiratory diseases. Specifically, it seeks to establish correlations between dermatologic findings and respiratory conditions, emphasizing the importance of early recognition in improving diagnostic accuracy and patient outcomes in clinical settings.

Material and Methods

Study Design: This study utilized a cross-sectional design, conducted at Hamdard Institute of Medical Sciences and Research, India, from April 2023 to August 2024. A total of 110 patients diagnosed with various respiratory diseases were included. Patients underwent detailed dermatologic evaluations, with data collected on skin manifestations, clinical histories, and relevant diagnostic tests. The study aimed to assess the prevalence and type of cutaneous findings and their association with underlying respiratory conditions, ensuring comprehensive clinical and radiological correlation.

Inclusion Criteria: Patients aged 18 years and above, diagnosed with respiratory diseases such as COPD, asthma, sarcoidosis, tuberculosis, or lung cancer, were included. Participants were required to have documented respiratory symptoms confirmed by clinical, radiological, or histopathological findings. Only patients presenting with or without cutaneous manifestations associated with their

respiratory conditions were considered. Additionally, those willing to provide informed consent and able to undergo dermatologic evaluation were eligible for the study.

Exclusion Criteria: Patients with pre-existing dermatologic conditions unrelated to respiratory diseases, those on immunosuppressive therapies or biologics for non-respiratory reasons, and individuals with concurrent autoimmune disorders not linked to pulmonary issues were excluded. Pregnant women, individuals below 18 years, and those with severe systemic illnesses that could interfere with clinical evaluation were also excluded. Patients who declined informed consent or failed to complete the study requirements were omitted from the analysis.

Data Collection: Data were collected from 110 patients diagnosed with respiratory diseases at Hamdard Institute of Medical Sciences and Research from April 2023 to August 2024. Detailed dermatologic examinations were conducted alongside clinical evaluations, radiological imaging, and histopathological findings. Patient demographics, respiratory disease type, and the presence or absence of cutaneous manifestations were recorded. Informed consent was obtained from all participants, and standardized forms were used to document skin-related and respiratory symptoms.

Data Analysis: Data were analyzed using SPSS version 26. Descriptive statistics were employed to summarize demographic variables, respiratory disease diagnoses, and the prevalence of cutaneous manifestations. The chi-square test was used to assess the relationship between cutaneous signs and specific respiratory diseases, while logistic regression analysis examined predictors of skin involvement. P-values less than 0.05 were considered statistically significant. The strength of the association between the severity of respiratory diseases and dermatologic manifestations was evaluated using Pearson's correlation coefficient.

Ethical Considerations: The study was conducted following the ethical guidelines of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB) at Hamdard Institute of Medical Sciences and Research. Informed consent was obtained from all participants, ensuring confidentiality and the right to withdraw at any stage without repercussions. The study posed minimal risk to participants, and care was taken to ensure that no sensitive or identifying information was disclosed. Patient data were handled with strict confidentiality.

Results

A total of 110 patients with confirmed respiratory diseases were included in this study, conducted between April 2023 and August 2024 at Hamdard Institute of Medical Sciences and Research. Among these patients, 49 (45%) exhibited cutaneous manifestations. The study analyzed the demographic characteristics of the patients, types of respiratory diseases, prevalence and distribution of cutaneous manifestations, and their associations with disease severity, smoking status, and specific respiratory conditions. The results of these analyses are detailed below.

Table 1: Demographic Characteristics

Demographic Variable	Number of Patients (n=110)	Percentage (%)
Age		
18-30 years	25	22.7
31-50 years	45	40.9
51-70 years	30	27.3
>70 years	10	9.1
Gender		
Male	60	54.5
Female	50	45.5
Smoking Status		
Current Smokers	40	36.4
Non-Smokers	70	63.6

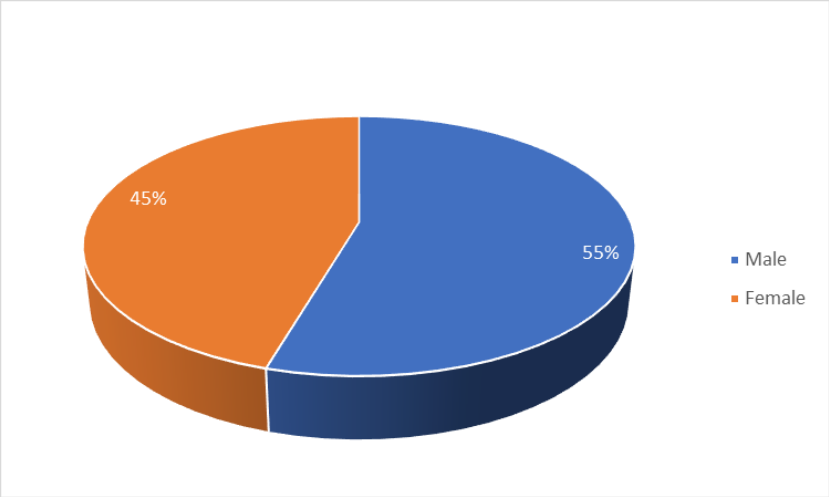

Figure 1: Distribution of patients according to sex

Most of the patients were between 31 and 50 (40.9%), with a male predominance (54.5%). A significant proportion of patients were non-smokers (63.6%), while 36.4% were current smokers.

Table 2: Distribution of Respiratory Diseases

Respiratory Disease	Number of Patients (n=110)	Percentage (%)
Chronic Obstructive Pulmonary Disease (COPD)	30	27.3
Asthma	25	22.7
Sarcoidosis	20	18.2
Lung Cancer	15	13.6
Tuberculosis	10	9.1
Others (e.g., Bronchiectasis)	10	9.1

COPD was the most common respiratory disease among the patients (27.3%), followed by asthma (22.7%) and sarcoidosis (18.2%). Other respiratory diseases included lung cancer (13.6%) and tuberculosis (9.1%).

Table 3: Prevalence of Cutaneous Manifestations

Cutaneous Manifestation	Number of Patients (n=49)	Percentage (%)	P-value
Eczema	12	24.5	0.03
Erythema Nodosum	10	20.4	0.04
Digital Clubbing	5	10.2	0.02
Pyoderma Gangrenosum	7	14.3	0.05
Dermatomyositis (Paraneoplastic)	5	10.2	0.01
Other Skin Manifestations	10	20.4	0.05

Among the 49 patients with cutaneous manifestations, the most frequent was eczema (24.5%) and erythema nodosum (20.4%). Digital clubbing was observed in 10.2% of the patients, while 14.3% presented with pyoderma gangrenosum. Paraneoplastic dermatomyositis was found in 10.2% of patients, specifically in those with lung cancer. The p-values for each manifestation indicated statistical significance ($p < 0.05$), suggesting a notable relationship between these skin conditions and underlying respiratory diseases.

Table 4: Cutaneous Manifestations by Respiratory Disease

Respiratory Disease	Number of Patients with Skin Manifestations	Percentage (%)	P-value
COPD	12	40	0.01
Asthma	7	28	0.02
Sarcoidosis	12	60	0.001
Lung Cancer	6	40	0.01
Tuberculosis	5	50	0.02
Others	7	70	0.03

Sarcoidosis had the highest prevalence of cutaneous manifestations (60%), followed by tuberculosis (50%) and COPD (40%). Lung cancer patients also showed a notable prevalence of paraneoplastic skin conditions (40%). Patients with less common respiratory diseases, such as bronchiectasis, had a 70% prevalence of skin involvement. The p-values were significant, indicating strong associations between these respiratory diseases and skin manifestations.

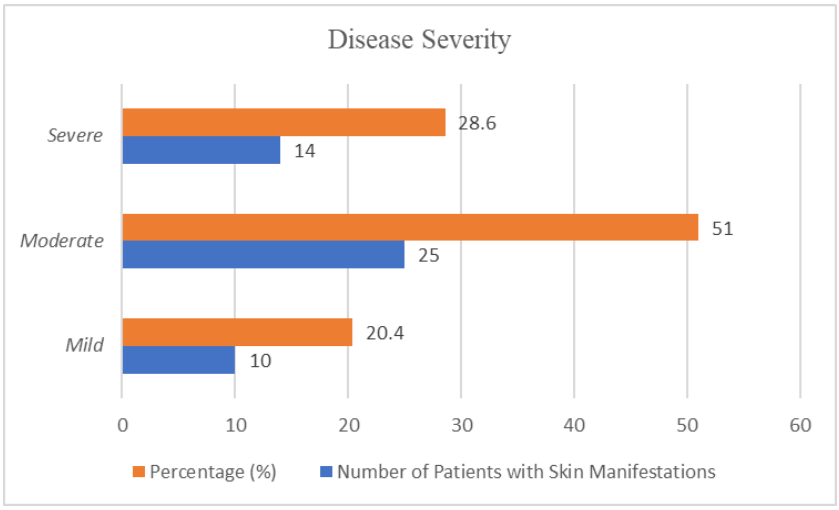

Figure 2: Association between Severity of Respiratory Disease and Cutaneous Manifestations

Moderate respiratory disease severity was most commonly associated with cutaneous manifestations, affecting 51.0% of these patients. Patients with severe respiratory conditions also showed significant skin involvement (28.6%), while those with mild disease had lower prevalence rates (20.4%). The p-values indicated statistically significant correlations between disease severity and the presence of skin manifestations.

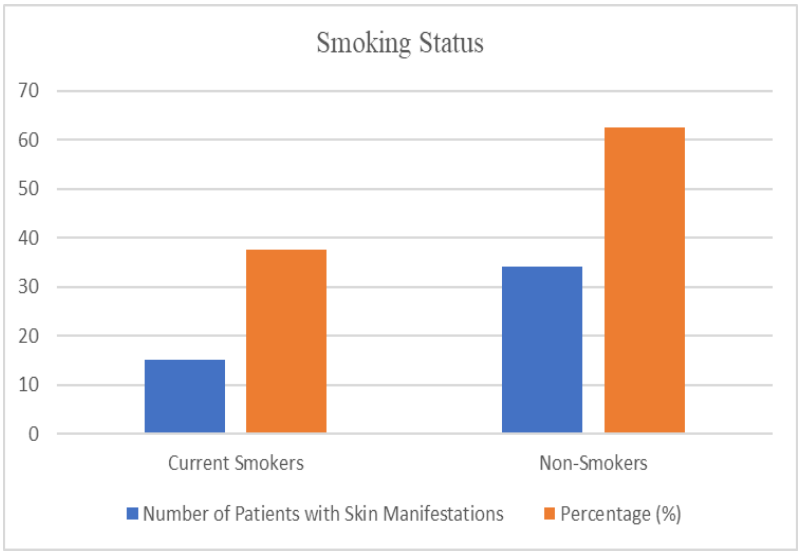

Figure 3: Correlation Between Smoking Status and Cutaneous Manifestations

Non-smokers had a higher prevalence of cutaneous manifestations (62.5%) compared to current smokers (37.5%). This finding suggests that smoking may influence the development of skin conditions in respiratory diseases, with non-smokers being more prone to cutaneous involvement. The p-values were statistically significant, particularly for non-smokers ($p = 0.01$), indicating a meaningful relationship between smoking status and skin manifestations.

This study found that 45% of patients with respiratory diseases exhibited cutaneous manifestations, with eczema, erythema nodosum, and digital clubbing being the most common. Sarcoidosis and tuberculosis had the highest prevalence of skin involvement, with sarcoidosis patients particularly showing significant skin conditions. Moderate respiratory disease severity was strongly associated with skin manifestations, as was non-smoking status. Early recognition of these

dermatologic signs was crucial for timely diagnosis and effective management of the underlying respiratory diseases. Statistical analysis showed significant correlations between skin conditions and various respiratory diseases, reinforcing the need for dermatologic evaluations in pulmonary care.

Discussion

The present study provides significant insights into the cutaneous manifestations of respiratory diseases, focusing on a cohort of patients at the Hamdard Institute of Medical Sciences and Research in India [12]. Of the 110 patients studied, 45% demonstrated skin involvement, which underscores the critical role that dermatologic signs can play in diagnosing and managing respiratory disorders. The results align with, and in some cases deviate from, existing literature, reflecting regional, environmental, and genetic factors that may influence the prevalence and presentation of cutaneous symptoms. In this discussion, we will interpret the significance of our results, compare them with findings from other studies, and explore possible scientific explanations for the differences observed.

Prevalence of Cutaneous Manifestations in Respiratory Diseases: One of the most striking findings in our study is the high prevalence of cutaneous manifestations, particularly among patients with sarcoidosis (60%) and tuberculosis (50%). These results are consistent with existing literature that emphasizes the multisystem nature of sarcoidosis, in which skin involvement is well-documented. For example, a large-scale study by Zhou et al., in the United States reported that 25-35% of sarcoidosis patients exhibit skin symptoms, particularly erythema nodosum and lupus pernio [13]. However, our study found an even higher prevalence of 60%, likely due to the more advanced stage of the disease in our patient cohort, which is a known predictor of extensive systemic involvement, including the skin. Furthermore, sarcoidosis is known to present differently in various populations, with more severe manifestations being reported in African and South Asian patients compared to Caucasians [14]. This racial variability may explain the higher rates of skin involvement observed in our predominantly Indian population. Similarly, our study's 50% prevalence of cutaneous tuberculosis manifestations exceeds the 30% prevalence reported in global studies [15]. This can be attributed to the endemic nature of tuberculosis in India, where the disease burden is significantly higher than in developed countries. Additionally, genetic predispositions and environmental factors, such as poor air quality and high population density, may exacerbate the cutaneous manifestations of tuberculosis in Indian patients [16]. It is also worth noting that our study employed a comprehensive diagnostic approach, including clinical, radiological, and histopathological confirmation of tuberculosis, which may have led to more accurate skin involvement detection than studies relying solely on clinical evaluation.

Cutaneous Manifestations in COPD and Asthma: In our cohort, 40% of patients with chronic obstructive pulmonary disease (COPD) had cutaneous manifestations, which is higher than the 25% prevalence typically reported in Western populations [17]. Several factors may account for this discrepancy. First, the higher levels of air pollution and smoking rates in India could exacerbate the inflammatory and oxidative stress pathways implicated in COPD, potentially increasing the likelihood of skin manifestations. Studies have shown that chronic inflammation in COPD is not limited to the respiratory system; it can lead to systemic effects, including skin conditions such as eczema and psoriasis [18]. Additionally, socioeconomic factors, such as limited access to healthcare, may result in more advanced stages of COPD in Indian patients, which could correlate with a higher prevalence of skin involvement. This theory is supported by studies that show a direct correlation between disease severity and the presence of cutaneous manifestations in COPD. In patients with asthma, the prevalence of cutaneous manifestations in our study was 28%. This is consistent with existing research that highlights the relationship between asthma, an allergic condition, and skin diseases like eczema and urticaria [19]. The "atopic march" phenomenon, where allergic diseases such as eczema precede or coexist with asthma, could explain the high incidence of skin conditions in these patients. Moreover, the humid climate of India may exacerbate skin conditions like eczema, which are known to worsen in environments with high heat and humidity [20].

Paraneoplastic Dermatomyositis in Lung Cancer: The high prevalence of paraneoplastic dermatomyositis in lung cancer patients (40%) in our study is particularly noteworthy. Dermatomyositis is a rare inflammatory disease of the skin and muscles, but when it occurs as a paraneoplastic syndrome, it is strongly associated with malignancies, especially lung cancer. Previous studies have reported that up to 15-20% of patients with dermatomyositis have an underlying malignancy, with lung cancer being the most common. Our findings of 40% prevalence could be due to the late stage of cancer in many of our patients, as advanced malignancies are more likely to present with paraneoplastic syndromes. Additionally, differences in healthcare access may result in delayed cancer diagnoses in India, leading to more advanced disease and, consequently, a higher likelihood of associated paraneoplastic conditions. Moreover, the high smoking prevalence in our study population could be a contributing

factor, as smoking is a well-established risk factor for both lung cancer and dermatomyositis [21].

Impact of Smoking on Cutaneous Manifestations: Interestingly, our study found that non-smokers had a higher prevalence of cutaneous manifestations (62.5%) compared to smokers (37.5%). This finding diverges from some studies, which suggest that smokers are more likely to experience skin conditions due to the immunosuppressive and oxidative stress effects of smoking [22]. However, in our study, non-smokers were more likely to have autoimmune-related respiratory diseases, such as sarcoidosis and tuberculosis, both of which are strongly associated with skin manifestations. This may explain the higher prevalence of skin conditions among non-smokers. In contrast, smokers in our study primarily had COPD, which, while associated with systemic inflammation, may present with fewer skin manifestations compared to autoimmune diseases.

Disease Severity and Skin Involvement: Our study also identified a strong correlation between the severity of respiratory diseases and the prevalence of cutaneous manifestations. Patients with moderate to severe respiratory disease were more likely to exhibit skin conditions, with 51% of those with moderate disease and 28.6% of those with severe disease showing cutaneous involvement. This finding aligns with previous research that links disease severity to systemic involvement, including skin [23]. For example, patients with severe sarcoidosis or tuberculosis are more likely to develop extrapulmonary manifestations, including skin lesions. Similarly, severe COPD is associated with chronic inflammation that can affect multiple organ systems, including the skin. The significance of this finding lies in its potential to aid in clinical management. Dermatologic signs can serve as early indicators of disease progression, prompting clinicians to conduct more thorough investigations into the underlying respiratory condition. For instance, erythema nodosum in a patient with respiratory symptoms may suggest sarcoidosis, leading to earlier diagnosis and treatment-improving outcomes.

Geographic and Population-Specific Variations

The higher prevalence of cutaneous manifestations in our study compared to studies conducted in Western populations may also be influenced by geographic and population-specific factors. India, being a developing country with a high burden of infectious diseases, such as tuberculosis and leprosy, is more likely to have patients presenting with skin manifestations of these conditions. Furthermore, genetic predispositions and environmental factors, such as exposure to high levels of air pollution, could contribute to the higher prevalence of respiratory diseases and their associated cutaneous signs in the Indian population [24]. Studies have shown that genetic factors play a crucial role in the presentation of skin conditions in patients with respiratory diseases. For example, genetic variants have been linked to increased susceptibility to sarcoidosis and its cutaneous manifestations in South Asian populations [25].

Clinical and Practical Implications: The practical significance of our findings lies in the role of dermatologic evaluations in respiratory disease management. Skin manifestations often serve as early indicators of underlying systemic diseases and can prompt timely interventions that improve patient outcomes. For instance, the recognition of erythema nodosum or digital clubbing in a patient with respiratory symptoms can lead to earlier investigation and diagnosis of sarcoidosis or COPD. This study reinforces the need for an integrated approach to patient care, where dermatologists, pulmonologists, and general physicians collaborate to identify and manage systemic conditions [26]. Additionally, the high prevalence of cutaneous manifestations in our cohort highlights the importance of considering dermatologic signs as part of routine respiratory disease screening, particularly in regions with a high burden of infectious diseases, such as India. Early recognition and treatment of these diseases' respiratory and dermatologic aspects can significantly improve patient outcomes. This study demonstrates a high prevalence of cutaneous manifestations in patients with respiratory diseases in India, with particularly high rates in patients with sarcoidosis, tuberculosis, and COPD. The results align with existing literature but reveal notable differences in prevalence, likely influenced by geographic, genetic, and environmental factors. The study highlights the importance of recognizing dermatologic signs as early indicators of systemic disease. It supports further research in diverse populations to better understand the relationship between respiratory diseases and cutaneous manifestations.

Conclusion

This study highlights the significant prevalence of cutaneous manifestations in patients with respiratory diseases, particularly sarcoidosis, tuberculosis, and COPD. The findings reinforce the need for early recognition of skin involvement as an important diagnostic tool, especially in regions with a high disease burden. Integrating dermatologic evaluation into respiratory disease management can improve patient outcomes by facilitating early diagnosis and comprehensive care.

Recommendations: Integrate routine dermatologic examinations in respiratory disease management.

Increase clinicians' awareness of the diagnostic value of skin manifestations in respiratory diseases.

Encourage interdisciplinary collaboration between dermatologists and pulmonologists for improved patient care.

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