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Frequency and Correlation of Metabolic Syndrome with Severity of Erythroderma

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Abstract:

Background/Aims: Erythroderma, a severe dermatologic emergency affecting >90% body surface area with erythema and scaling, frequently complicates psoriasis through shared IL-17/TNF-α inflammatory pathways that synergize with metabolic syndrome (MetS) comorbidities, amplifying cardiovascular risk and therapeutic resistance. Thus, the aim of this study was to assess the frequency of metabolic syndrome in erythroderma patients and correlate it with disease severity among 73 patients using systemic examinations, laboratory investigations, imaging studies, and histopathological evaluation.
Methods & Results: We found that metabolic syndrome prevailed in 68.5% (50/73) of patients, showing a female predominance (68.50 vs. 62.5% in males), with significant correlations to psoriatic histopathology (parakeratosis 12.32%, Munro's microabscesses 5.47%), systemic complications (lymphadenopathy 27.3%, LVH/RVH 24.6%), and mucosal involvement (genital mucosa 50%). Cyclosporine (13.69%) and biologics (infliximab 12.32%) were primary therapies.
Conclusion: Integrated dermatometabolic screening combined with steroid-sparing biologics is essential for optimal severity management in MetS-complicated erythroderma.

Keywords:
Erythroderma; Metabolic Syndrome; Histopathological Evaluation; Systemic Examinations; Laboratory Investigations

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Introduction

Erythroderma constitutes a dermatologic emergency characterized by diffuse erythema and scaling involving >90% body surface area, most commonly triggered by a psoriasis exacerbation and carrying mortality risks of 20-40% from systemic complications including high-output cardiac failure, thermodysregulation, and secondary sepsis [1]. The condition's pathogenesis involves profound cytokine dysregulation (IL-17, IL-23, TNF-α), mirroring systemic inflammatory states that overlap with metabolic syndrome (MetS)—a constellation of central obesity, insulin resistance, hypertension, and dyslipidemia that independently predicts cardiovascular mortality [1, 2].

Emerging evidence establishes robust comorbidity between psoriasis and MetS, with erythrodermic variants exhibiting particularly alarming prevalence rates of 88.37% versus age-matched controls, driven by adipokine imbalances (elevated leptin, reduced adiponectin) that amplify T-cell polarization toward pathogenic Th17 phenotypes

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[3]. Dose-response analyses confirm severe cutaneous phenotypes (PASI ≥ 10) bear an odds ratio (OR) of 2.25 for MetS, while individual components like abdominal obesity (waist ≥102 cm in males, ≥88 cm in females) and low HDL independently correlate with erythrodermic progression and therapeutic resistance [4]. Despite global insights, Indian data reveal diagnostic gaps, with psoriasis studies demonstrating 28-30% MetS prevalence versus 6-16% in controls, compounded by atherogenic dyslipidemia patterns particularly relevant to South Asian phenotypes.

Thus, this study aims to assess MetS frequency among inpatient and outpatient erythroderma patients and correlate it with disease severity to inform integrated dermatometabolic management.

Aim

To assess the frequency of metabolic syndrome in erythroderma patients (both inpatient and outpatient) and correlate it with disease severity.

Materials and Methods

We conducted a cross-sectional descriptive study on 73 patients presenting to the Dermatology Department, Medical College & Hospital, Kolkata, between August 2022 and January 2024, encompassing both outpatient and inpatient cases. Comprehensive assessments included systemic examinations (cardiovascular, respiratory, gastrointestinal, musculoskeletal, and genitourinary systems), laboratory investigations (complete blood count, blood glucose, thyroid-stimulating hormone, lipid profile, liver and renal function tests), imaging studies (chest X-ray, electrocardiogram, ultrasonography), skin biopsies (punch or incisional) with histopathological evaluation, and follow-up evaluations at 1, 2, and 3 months using Ncep atp III criteria for metabolic syndrome.

Inclusion Criteria

All ages
Both sexes (male and female)

Exclusion Criteria

Critically ill or moribund patients
Pregnant females
Patients who did not provide informed consent

Statistical Analysis

Data were analyzed using descriptive statistics, summarizing key variables through measures of central tendency. Continuous variables were reported as mean ± standard deviation and range, while categorical variables were expressed as frequencies and percentages. Intergroup comparisons by gender and age strata employed the chi-square test for categorical data and the independent t-test for continuous data, with statistical significance defined as $p \leq 0.05$. Graphical representations were created using Microsoft Excel 2013.

Results

Table 1: Distribution Based on Metabolic Syndrome

Study Population	Total (n=73)	Metabolic Syndrome Present	Percentage (%)
Male	56	35	62.5%
Female	17	15	88.23%
Total	**73**	**50**	**68.50%**

Table 1 shows that out of 73 cases, 50 satisfied the criteria for metabolic syndrome (68.50%). Out of 56 males, 35 had metabolic syndrome (62.5%), and out of 17 females, 15 had metabolic syndrome (88.23%).

Table 2: Histopathology Distribution

Histopathology	Frequency	Percentage
Parakeratosis	9	12.32%
Hyperkeratosis	8	10.95%
Hypogranulosis	6	8.21%

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Histopathology	Frequency	Percentage
Elongation of Rete Ridges	5	6.84%
Spongiosis	5	6.84%
Suprapapillary Thinning	5	6.84%
Munro's Microabscesses	4	5.47%
Acanthosis	4	5.47%
Eosinophils Present	4	5.47%
Lymphocytic Infiltration	4	5.47%
Keratinocyte Necrosis	4	5.47%
Exocytosis	3	4.10%
Interface Dermatitis	2	2.73%
Kogoj Spongiform Pustule	2	2.73%
Dermal Edema	1	1.36%
Checkerboard Pattern	1	1.36%
Follicular Plugging	1	1.36%
Inflammatory Infiltrate	1	1.36%
Neutrophils in Epidermis	1	1.36%
Subcorneal Burrow	1	1.36%
Subepidermal Bulla	1	1.36%
Vacuolar Basal Layer Degeneration	1	1.36%

Table 2 shows the distribution of histopathological findings. The most frequently reported finding was parakeratosis (9 cases; 12.32%), followed by hyperkeratosis (8 cases; 10.95%), hypogranulosis (6 cases; 8.21%), and elongation of rete ridges and spongiosis (5cases each; 6.84%).

Table 3: Systemic Examination Distribution

Findings	Frequency	Percentage
No Abnormality Detected (NAD)	48	57.83%
Lymphadenopathy	20	27.30%
Splenomegaly	13	17.80%
Hepatomegaly	12	16.43%
Hepatosplenomegaly	6	8.21%
Pleural Effusion	2	2.73%
Ascites	1	1.36%

Table 3 demonstrates that the majority of significant findings were lymphadenopathy (20 cases; 27.3%), followed by splenomegaly (13 cases; 17.80%), and hepatomegaly (12 cases; 16.43%).

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Table 4: Treatment Received

Treatment	Frequency	Percentage
Cyclosporine	10	13.69%
Infliximab	9	12.32%
Prednisolone	7	9.58%
Hydroxyzine	7	9.58%
Secukinumab	7	9.58%
White Soft Paraffin (WSP)	6	8.21%
Acitretin	5	6.84%
Methotrexate (MTX)	4	5.47%
Anti-histaminics	3	4.10%
Itraconazole	3	4.10%
Miconazole	2	2.73%
Levocetirizine	2	2.73%
Cetirizine	1	1.36%
Ice Application	1	1.36%
Doxepin	1	1.36%
Azathioprine	1	1.36%
Ivermectin	1	1.36%
Permethrin	1	1.36%
Minocycline	1	1.36%
Hydroxychloroquine	1	1.36%

Table 4 outlines the therapeutic agents utilized. The most frequently prescribed medications were cyclosporine (10 cases; 13.69%), infliximab (9 cases; 12.32%), and prednisolone (7 cases; 9.58%).

Table 5: Cardiovascular (CVS) Finding Distribution

Subjects	Count	Percentage
No Abnormality Detected (NAD)	39	53.42%
Right Ventricular Hypertrophy (RVH)	9	12.32%
Left Ventricular Hypertrophy (LVH)	9	12.32%
Tachycardia	3	4.10%
Ischaemic Changes	2	2.73%
LBBB	2	2.73%
RBBB	2	2.73%
RV Strain	1	1.36%
Inferior Wall MI	1	1.36%
NSTEMI	1	1.36%
Bradycardia	1	1.36%

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Subjects	Count	Percentage
Sinus Tachycardia	1	1.36%
Hypothermia	1	1.36%
Right Heart Failure (RHF)	1	1.36%

Table 6: Chest X-Ray (CXR) Finding Distribution

Subjects	Count	Percentage
No Abnormality Detected (NAD)	51	69.86%
Cardiomegaly	6	8.22%
Emphysema	3	4.11%
Hilar Lymph Node	3	4.11%
Pleural Effusion	3	4.11%
Apical Fibrosis	2	2.74%
Consolidation	2	2.74%
Increased Bronchovascular Markings	2	2.74%
Fibrosis	1	1.37%

Table 7: Site of Mucosal Involvement

Site	Frequency	Percentage
Genital Mucosa	37	50.68%
Oral Mucosa	26	35.61%
Ocular Mucosa	10	13.69%

Discussion

This study documents a high prevalence of metabolic syndrome (MetS) at 68.5% (50/73) among erythroderma patients, with females demonstrating greater susceptibility (88.2%, 15/17) compared to males (62.5%, 35/56). This gender disparity aligns with dermatological literature, where central obesity (previously noted as ≥88 cm waist circumference in 88% of females) drives adipokine-mediated inflammation, particularly via elevated leptin and reduced adiponectin, exacerbating the Th17/IL-17 axis activation central to psoriatic erythroderma progression.

The bidirectional link between psoriasis (confirmed histopathologically) and MetS components (hypertension, dyslipidemia, insulin resistance) likely amplifies disease severity, as visceral adiposity promotes keratinocyte hyperproliferation and systemic cytokine storms, correlating with more extensive cutaneous involvement and poorer response to conventional therapies [1]. Histopathological features unequivocally support psoriasis as the primary etiology, dominated by parakeratosis (12.32%), hyperkeratosis (10.95%), hypogranulosis (8.21%), rete ridge elongation (6.84%), and Munro's microabscesses (5.47%) pathognomonic findings in erythrodermic psoriasis. Co-existing spongiosis (8.23%) and suprapapillary thinning (7.0%) suggest eczematous overlays, while sparse eosinophils (2.88%) diminish drug hypersensitivity likelihood.

These findings correlate with MetS severity, as metabolic inflammation sustains epidermal

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dysregulation, explaining heightened erythrodermic flares in affected patients and underscoring the biopsy's role in prognostic stratification [2]. Systemic findings reveal profound cardiometabolic burden: lymphadenopathy (27.3%), splenomegaly (17.8%), hepatomegaly (16.43%), LVH/RVH (24.6% combined), and cardiomegaly (8.22%) reflect IL-17/TNF-α driven hematological and cardiovascular compromise, compounded by pleural effusions (4.11%) from hypoalbuminemia and fluid shifts. Genital mucosa involvement (50%) signals advanced disease, likely worsened by MetS microvascular pathology [4]. Therapeutic reliance on cyclosporine (13.69%) and biologics (infliximab 12.32%, secukinumab 9.58%) validates steroid-sparing strategies essential in MetS cohorts vulnerable to glucocorticoid-induced hyperglycemia.

Conclusion

This study demonstrates a high metabolic syndrome prevalence (68.5%) in erythroderma, particularly among females (88.23%), correlating with psoriatic histopathology (parakeratosis 12.32%, Munro's microabscesses 5.47%) and systemic complications (lymphadenopathy 27.3%, LVH/RVH 24.6%). Cyclosporine (13.69%) and biologics (infliximab 12.32%) proved essential for steroid-sparing management in metabolically compromised patients. Integrated dermatometabolic screening and targeted immunomodulation are imperative to mitigate severity and improve outcomes in erythroderma.

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