

# Clinical study of linear dermatoses and their histopathological correlation in a tertiary care hospital

Meghana Patil, Pradeep Vittal Bhagwat\*, Chandramohan Kudligi, Jayashree Basavaraju, Veena Ullas Nair, Varsha Muchal Prakash, Fouziya Masarrat, Tejaswini Mukundraj, Ravi Munasingh Rathod

Department of Dermatology Venereology and Leprology, Karnataka Institute of Medical Sciences, Hubballi, Karnataka, India.

\* KLE Jagadguru Gangadhar Mahaswamigalu Moorusavirmath Medical College and Hospital, Gabbur Cross, Hubballi, India.

## Abstract

**Objective** To analyze the clinical presentation of various linear dermatoses and establish their correlation with histopathology at the skin out-patient department of Karnataka Institute of Medical Sciences, Hubli, from January 2021 to June 2022.

**Methods** Comprehensive patient histories, encompassing family history and trauma, were collected. Clinical examinations led to provisional diagnoses. Biopsies were conducted for histopathological examination with patient consent. Additional investigations were performed if deemed necessary.

**Results** Out of 90 cases, Lichen striatus was the most prevalent presentation, followed by herpes zoster, linear verrucous epidermal nevus, and linear lichen planus. Among patients undergoing biopsies, a 100% clinico-pathological correlation was noted for linear verrucous epidermal nevus and nevus depigmentosus. Correlation rates were 95% for lichen striatus, 90% for lichen planus, and one case clinically diagnosed as nevus sebaceous exhibited linear verrucous epidermal nevus features on histopathology.

**Conclusion** This study underscores the pivotal role of histopathological correlation, which significantly influences management decisions. The distinct management approaches for various linear dermatoses reinforce the necessity of histopathological examination for accurate diagnoses and tailored treatments.

## Key words

Linear dermatoses; Histopathological correlation.

## Introduction

The skin, an expansive and vital human organ, spans around 2 square meters and constitutes approximately 16% of an adult's body weight. Functioning as a dynamic and versatile shield, human skin orchestrates a complex defense against external elements by means of its intricately organized structure.<sup>1</sup>

In the meticulous analysis of skin, the configuration, arrangement, and distribution of lesions hold significant diagnostic value. These

visual cues, when examined collectively, often provide rapid insights into potential dermatologic conditions.<sup>2</sup> The diverse range of lesion patterns, including discoid, petaloid,

## Manuscript

Received on: August 24, 2023

Revised on: November 30, 2023

Accepted on: April 19, 2024

## Address for correspondence

Dr. Chandramohan Kudligi, Professor,  
Department of Dermatology and Venereology  
Room 100, OPD, Karnataka Institute of Medical  
Sciences, Hubballi, Karnataka, India.

Ph: 09845089897

Email: drchandramohankims@gmail.com

arcuate, annular, polycyclic, livedo, reticulate, target, stellate, digitate, linear, serpiginous, and whorled, offer a rich array of diagnostic possibilities.<sup>3</sup> Among these patterns, the linear configuration of a lesion holds particular diagnostic potential, acting as a catalyst for the recognition of various dermatologic ailments.<sup>3</sup> Whether an individual lesion adopts a linear shape or multiple lesions align in a linear arrangement, these patterns offer valuable clinical indications.

The intricate mechanisms and anatomical factors that underlie linear configurations can be categorized as follows:<sup>4,5</sup>

- Linear configurations shaped by blood vessels, encompassing conditions such as thrombophlebitis, Mondor's disease, varicose veins, temporal arteritis, and polyarteritis nodosa.
- Linear arrangements influenced by lymphatic pathways, including lymphangitis and sporotrichosis.
- Linear patterns influenced by nerve trunks, as observed in leprosy cases.

Noteworthy among linear lesions are those of developmental origin, following the unique paths known as Blaschko's lines.<sup>4,5</sup> These include:

- Macules and patches exemplified by conditions like incontinentia pigmenti, hypomelanosis of Ito, linear and whorled nevoid hypermelanosis, and nevus depigmentosus.
- Papules and plaques as seen in morphea, Goltz syndrome, lichen striatus, adult Blaschkitis, linear epidermal nevus, linear form of psoriasis, lichen planus, lichen nitidus, porokeratosis, Darier's disease, and Hailey-Hailey disease.
- Vesicular presentations typified by incontinentia pigmenti.

Furthermore, linear lesions can also arise due to

external factors, such as plants, allergens, chemicals (e.g; Paederus dermatitis, Berloque dermatitis, phytophotodermatitis), and thermal or physical triggers, including the Koebner phenomenon. Linear patterns following dermatomal arrangements are observed in cases like herpes zoster, zosteriform nevus, and segmental vitiligo.

Additionally, linear configurations can be attributed to other factors:

- Linear scleroderma.
- Dermatomyositis, notably the Gottron sign on the dorsum of fingers.
- Flagellate pigmentation caused by bleomycin.
- Infestations like cutaneous larva migrans and scabies burrows.
- Skin stretching, leading to striae.

The majority of linear lesions align with Blaschko's lines, offering a compelling basis for clinical investigation. To this end, our study focuses on patients with linear lesions attending the Dermatology Outpatient Department at the Karnataka Institute of Medical Sciences, Hubli.

In summary, this introduction sets the stage for our exploration of linear dermatoses, encompassing a diverse spectrum of etiologies and patterns. Our endeavor is to illuminate the intricate relationships between clinical presentations and underlying anatomical or developmental factors, contributing valuable insights to the field of dermatology.

## **Methods**

This study encompasses a cohort of 90 cases presenting with various forms of linear dermatoses.

After receiving official endorsement and approval from the institutional ethical committee (No: KIMS:ETHICS COMM: 412: 2020-21,

dated 22-01-2021), the enrollment process began by identifying patients who met the predefined inclusion criteria. The study proceeded only after obtaining informed consent from these individuals. A comprehensive clinical assessment was conducted, coupled with histological evaluation, and standard blood and urine tests were conducted. When deemed necessary, radiological investigations were also employed.

A meticulous and comprehensive data collection process was initiated across all 90 cases. Comprehensive personal histories were documented, including address, occupation, and socioeconomic status. Particular attention was directed towards parental marital status to ascertain any potential genetic influences. Sibling history was diligently recorded to explore the possibility of an infectious origin when multiple siblings were afflicted by the same dermatosis. Rigorous physical examinations were conducted for each patient, with a heightened focus on detecting lymphadenopathy, mucosal alterations, hair changes, and nail anomalies. Furthermore, careful examinations of the genitalia, palms, and soles were conducted.

In instances of conditions like epidermal nevus syndrome, incontinentia pigmenti, and linear whorled nevoid hypermelanosis, interdisciplinary collaboration was pursued. Expert opinions from specialized departments such as Neurology, Ophthalmology, Oto-Rhino-Laryngology, Orthopaedics, and Dentistry were sought to ensure a comprehensive assessment.

For patients who qualified, skin biopsies were procured from the advancing edge of the lesions. These biopsy samples were meticulously examined using H & E staining to glean valuable insights into the underlying pathology.

In summary, the methodology employed for this

study aimed to comprehensively evaluate and characterize linear dermatoses. The multifaceted approach encompassing clinical assessment, histological analysis, and interdisciplinary collaboration ensured a thorough exploration of the diverse cases within this cohort.

## Results

During the study period spanning from January 2021 to June 2022, a total of 90 patients were enrolled for examination and analysis.

The daily influx of new cases at our Skin Outpatient Department at the Karnataka Institute of Medical Sciences, Hubli, averaged at 140 patients per day, culminating in a total of 75,600 new cases over the stated period.

The diverse age spectrum of patients was embraced within this study, ranging from a 2-month-old infant to a 64-year-old individual. Strikingly, a preponderance of lesions (55.5%) was observed in patients under 20 years of age, with the most commonly affected age groups being 0-10 years (33.3%) and 11-20 years (22.2%) (**Table 1**).

Gender distribution demonstrated that out of the 90 cases, 41 (45.6%) were males and 49 (54.4%) were females, resulting in a male-to-female ratio of 1:1.2. Within this cohort, 48 patients (53.3%) presented with asymptomatic lesions driven by anxiety or cosmetic concerns, while the

**Table 1** Age distribution of study participants (N=90).

Age groups (years)	Number	Percentage
0-10	30	33.3
11-20	20	22.2
21-30	13	14.4
31-40	13	14.4
41-50	6	6.7
More than 50	8	8.9
Total	90	100

**Table 2** Distribution of cases based on site of involvement.

Site	Number	Percentage
Scalp	2	2.2
Face	6	6.7
Retro-auricular area	9	10
Neck	15	16.7
Chest	17	18.9
Abdomen	11	12.2
Back	24	26.7
Upper limb	30	33.3
Lower limb	21	23.3
Palms	2	2.2
Soles	0	0
Genitals	0	0

**Table 3** Morphology of lesion.

Primary lesion	Number	Percentage
Macule	12	13.3
Papule	11	12.2
Plaque	3	3.33
Vesicle	15	16.7
Comedones	1	1.1
Macule and papule	15	16.7
Papule and plaque	32	35.6
Macule and vesicle	1	1.1
Total	90	100

remaining 42 (46.7%) experienced symptoms such as itching (32.2%) as the predominant complaint.

A predominant trend towards unilateral distribution of linear patterns was observed, with the right side (53.3%) being more commonly affected than the left side (40%). A smaller subset (6.7%) exhibited bilateral involvement.

Site distribution highlighted the upper limbs (33.3%) as the most commonly affected region, trailed by the back (26.7%), neck (26.7%, including retro-auricular region), lower limbs (23.3%), chest (18.9%), and abdomen (12.2%). Face (6.7%), scalp (2.2%), and palms (2.2%) exhibited infrequent involvement, while soles remained entirely unaffected. Notably, genital lesions described in existing literature were conspicuously absent from our study (**Table 2**).

In terms of morphological patterns, papules and plaques (35.6%) ranked as the most common,

followed by maculopapular lesions (16.7%), vesicular lesions (17.7%), solitary macules (13.3%), papular lesions (12.2%), plaques (3.3%), and comedones (1.1%) (**Table 3**).

Of the cases studied, 8.9% had a history of consanguinity. These occurrences primarily presented as sporadic cases, contributing to the low rate of consanguineous links observed.

The majority (66.7%) of patients displayed solitary linear lesions. Noteworthy exceptions included conditions like Incontinentia pigmenti, linear whorled nevoid hypermelanosis, and systematized epidermal nevi, which demonstrated bilateral distribution with multiple lesions (5.6%).

Among the specific cases (**Table 4**) lichen striatus (**Figure 1**) (28.9%) held the top spot, followed by herpes zoster (16.7%), linear verrucous epidermal nevi (15.6%) (**Figures 2,3**), linear lichen planus (13.3%), Incontinentia pigmenti (1.1%) (**Figure 4**) and speckled lentiginous nevus (1.1%) (**Figure 5**). Interestingly, none of these cases displayed a familial history of similar lesions. Lichen

**Table 4** Distribution of study participants based on clinical diagnosis.

Final diagnosis	Number	Percentage
Lichen striatus	26	28.9
Linear lichen planus	12	13.3
LVEN	15	16.7
Nevus sebaceous	1	1.1
Nevus comedonicus	1	1.1
Speckled lentiginous nevus	1	1.1
Nevus depigmentosus	6	6.7
Segmental vitiligo	4	4.4
Linear whorled nevoid hypermelanosis	1	1.1
Incontinentia pigmenti	1	1.1
Linear morphea	1	1.1
Blaschkitis	3	3.3
Linear psoriasis	3	3.3
Herpes zoster	15	16.7
Total	90	100.0



**Figure 1** Lichen striatus involving trunk and arm.



**Figure 2** Linear verrucous epidermal nevus (lven).



**Figure 3** Systematised epidermal nevus involving multiple sites.

striatus appeared in 26 patients, predominantly within the age range of 2 to 24 years, with an average age of 8 years. Among these cases, 96.2% were under the age of 20, and 73.1% were under the age of 10. The gender distribution was notable, with 65.4% being female. Clinical presentations included both asymptomatic (61.5%) and itching-related cases (38.5%), with duration ranging from 15 days to 1 year. Unilateral distribution on the right side (61.5%) and left side (38.5%) was typical, and no bilateral involvement was observed.

Histopathological evaluations yielded important insights. Skin biopsies were conducted on 21 cases, revealing patterns consistent with lichenoid dermatitis, chronic dermatitis, and psoriasiform dermatitis, along with the distinctive alignment of infiltrates along hair follicles and/or eccrine ducts characteristic of lichen striatus.

A similar depth of analysis was applied to other conditions studied, such as Blaschkitis, linear epidermal verrucous nevus (LVEN), herpes zoster, linear lichen planus, nevus depigmentosus, segmental vitiligo, and linear psoriasis, each offering unique clinical and histopathological insights into these conditions.

## Discussion

Linear skin lesions are visually distinct and diagnostically valuable in various disorders. However, their interpretation can be challenging due to the broad range of possible differential diagnoses.

This study examined 90 clinically diagnosed cases of linear dermatoses at the Skin and STD Outpatient Department of the Karnataka Institute of Medical Sciences, Hubballi. These linear lesions exhibited Blaschko's lines, suggesting a cutaneous embryogenesis pattern. The clinical profiles and clinicopathological features of these patients were investigated and compared with similar studies.

The observed incidence of linear dermatoses during the period of January 2021 to June 2022 was 0.1% in our skin OPD. The majority of cases (55.5%) were below the age of 20, with a significant proportion (33.3%) falling within the 0-10 years age group. This aligns with findings from Dastikop *et al.*,<sup>6</sup> Manangi S *et al.*,<sup>5</sup> and Sarawathy P *et al.*,<sup>7</sup> where the prevalence among younger age groups was highlighted. On the other hand, Suriyan SPPU *et al.*<sup>8</sup> showed no sex predilection, indicating varying gender



**Figure 4** Incontinentia pigmenti.



**Figure 5** Speckled lentiginous nevus.

distributions across studies. Regarding symptomatology, itching emerged as the most common symptom among symptomatic patients (46.7%), whereas a significant portion (53.3%) were asymptomatic. This is in line with Dastikop *et al.*<sup>6</sup> and Manangi S *et al.*<sup>5</sup> where asymptomatic patients often sought medical attention for cosmetic or anxiety-related reasons. Lesion distribution exhibited predominantly unilateral patterns (93.3%) in the current study, most commonly affecting the upper limbs (33.3%). Right-sided involvement (53.3%) prevailed, differing from the left-sided preponderance noted by Dastikop *et al.*<sup>6</sup> the present findings align with Dastikop *et al.*<sup>6</sup> and Manangi S *et al.*<sup>5</sup> in terms of lower limb involvement and sparing of palms.

Histopathological examination played a crucial role in this study, with 100% correlation observed for linear verrucous epidermal nevus and nevus depigmentosus diagnoses, 95% for

lichen striatus, and 90% for linear lichen planus. Histopathology offered distinct diagnoses for cases clinically diagnosed as nevus sebaceous and lichen striatus.

## Conclusion

In summary, our study shed light on the clinical and histopathological correlation of linear dermatoses. We found that linear dermatoses are common among younger age groups, with females being slightly more affected.

The observed cases followed patterns of Blaschko's lines, supporting the concept of cutaneous embryogenesis. Various linear dermatoses were identified, with lichen striatus being the most prevalent. Histopathological correlation proved invaluable in refining diagnoses and guiding treatment strategies.

**Declaration of patient consent** The authors certify that they have obtained all appropriate patient consent.

**Financial support and sponsorship** None.

**Conflict of interest** Authors declared no conflict of interest.

## Authors' contribution

**MP:** Contribution to study design, drafting the manuscript, final approval of the version to be published.

**VMP:** Acquisition of data, critically review, final approval of the version to be published.

**PVB, VUN, TM:** Analysis and interpretation of data, drafting the manuscript, final approval of the version to be published.

**CK:** Conception, design and interpretation of data, drafting the manuscript, final approval of the version to be published.

**JB, FM:** Contribution to conception and design, drafting the manuscript, critically review, final approval of the version to be published.

**RMR:** Contribution to acquisition of data, final approval of the version to be published.

## References

1. Barker J, Bleiker TO, Chalmers R, Griffiths CE, Creamer D, editors. Rook's textbook of dermatology. John Wiley & Sons; 2016 Feb 29. p. 2.1.
2. Barker J, Bleiker TO, Chalmers R, Griffiths CE, Creamer D, editors. Rook's textbook of dermatology. John Wiley & Sons; 2016 Feb 29. p. 4.5.
3. Das A, Mohanty S, Gharami RC, Chowdhury SN, Kumar P, Das NK, *et al.* Linear lesions in dermatology: a clinicoetiopathological study. *Clin Exp Dermatol.* 2021;**46(8)**:1452-61.
4. Malvankar DD, Sacchidanand S, Mallikarjun M, Nataraj HV. Linear lesions in dermatology. *Indian J Dermatol Venereol Leprol.* **2011**;**77**:722.
5. Manangi S, Anirudh M, Sivuni A, Smrutha H, Reddy S. A clinical study on linear dermatoses at a tertiary care teaching hospital in Davangere. *Int J Res Dermatol.* 2021;**7**:201-6.
6. Dastikop SV, Manjunath S, Manohar N, Pise GA, Patil MN. Clinico-pathological correlation of linear dermatoses along the lines of Blaschko: An observational study. *IP Indian J Clin Exp Dermatol* 2021;**7(4)**:288-95.
7. Saraswathy P, Nithya Gayathri Devi D, Sivarajani J. Study on linear dermatoses. *Int J Res Dermatol.* 2018;**4**:190-6.
8. Suriyan SPPU, Swaminathan A, Muralidharan K, *et al.* A clinical study on linear dermatoses occurring in paediatric age group. *J Evolution Med Dent Sci.* 2017;**6(89)**:6184-8.