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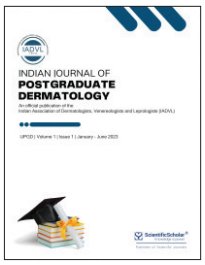

Review Article

Faculty's Forum: Approach to Learning Dermatopathology during Postgraduate Residency

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ABSTRACT

Skin biopsy is an indispensable diagnostic modality for a dermatologist and dermatopathology is an important part of the dermatology residency curriculum. Clinicopathological correlation is often required to reach a diagnosis in dermatological disorders and therefore it is imperative that basic dermatopathology is learnt during residency to facilitate patient management. This article aims to provide insights on the importance of learning the subject, what a resident is expected to know at the end of residency programme, and how to master the basic skills including reading the slide and describing the histopathological features. The available reading resources have also been suggested.

Keywords: Dermatopathology, Learning dermatopathology, Dermatology residency

INTRODUCTION

Dermatopathology is an allied subspeciality of dermatology and pathology that hold its importance in the field of diagnostics. The scope of the subject is expanding and besides the conventional routine microscopy, includes advanced techniques like immunofluorescence, immunohistochemistry, molecular studies, etc.

WHY TO LEARN DERMATOPATHOLOGY?

Skin biopsy is an indispensable diagnostic modality for a dermatologist. Being conversant with the principles of anatomical, physiological and histological aspects undoubtedly forms a solid foundation for conceptual learning and practicing clinical dermatology. The histopathological findings are essentially the reflection of pathogenic alterations brought about by the underlying etiological factor(s) of the disease, whether infective, immunological or neoplastic. Accurate diagnosis in a significant proportion of dermatologic conditions, especially inflammatory dermatoses, requires clinicopathological correlation. The expertise in dermatopathology would help reach a specific diagnosis or at least narrow down the list of differentials and provide direction to the clinician for appropriate patient management. Understandably, the diagnostic yield relies on the interplay between the clinician and the dermatopathologist, and the dermatology residency programme is interesting and unique that allows access to both the clinical and histopathological aspect of each case. Dermatopathology as a subject is not only fascinating but also intriguing as well as challenging at times. A clinician with a working knowledge of dermatopathology is better equipped in diagnosis as well as management of dermatological conditions. Moreover,

it is an important section in theory as well as practical examination, along with being a scoring subject in quizzes. It is therefore imperative that basic dermatopathology is learnt during residency and those interested in pursuing dermatopathology after post-graduation can explore training avenues in dermatopathology in India and abroad.[1] Indian Association of Dermatologists, Venereologists, and Leprologists provides observership programmes and training opportunities in various subspecialities of dermatology, including dermatopathology. The notifications and details can be checked on the official website.

EXCERPTS PERTAINING TO DERMATOPATHOLOGY FROM NATIONAL MEDICAL COUNCIL CURRICULUM FOR COMPETENCY-BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN DERMATOLOGY, VENEREOLOGY AND LEPROSY

At the end of the residency, students are expected to acquire the following competencies:[2]

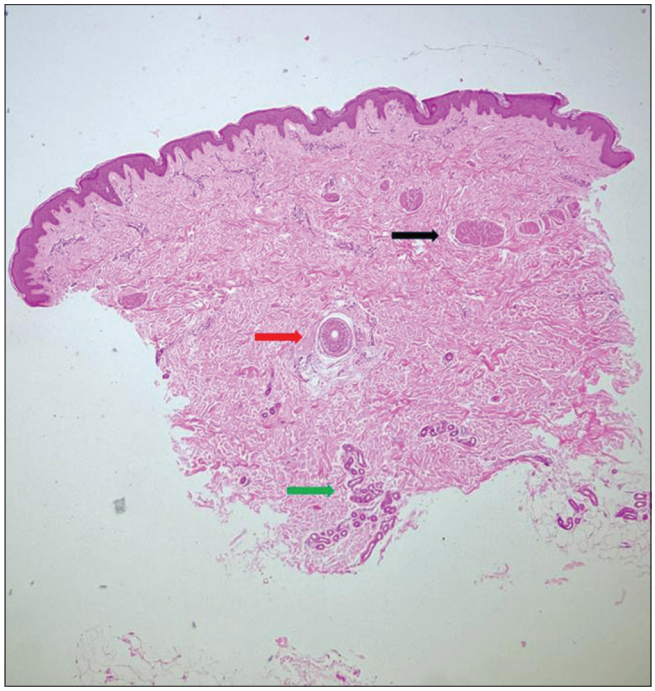

Figure 1: Normal skin biopsy showing epidermis, dermis and apical part of subcutaneous tissue. Note that the epidermal side has been placed on top as convention. Adnexal structures seen are arrector pilorum muscle (black arrow), hair follicle (red arrow), eccrine glands and ducts (green arrow) [Haematoxylin and eosin (H and E), x40].

- Describe basic pathologic reaction patterns
- Interpret histopathology of common skin diseases
- Know about the routinely used laboratory stains and procedures, along with special techniques such as immunofluorescence and immunoperoxidase
- Histopathology slides to be included in the practical examination
- Teaching methodology includes all postgraduate students to attend Clinicopathological Conference (CPC) as an inter-departmental meeting between dermatology and pathology departments. Interesting cases may be chosen and presented by the postgraduate students in rotation. If cases are not available, it could be supplemented by published CPCs. In these sessions, the advances in immunohistochemical techniques can be discussed.

GETTING PRIMED TO LEARN DERMATOPATHOLOGY

During the initial few months of residency, the focus should be on learning the proper skin biopsy sampling

Table 1: Major and minor histological tissue reaction patterns.

Major tissue reaction patterns	Minor tissue reaction patterns
Psoriasiform	Acantholytic dyskeratosis
Vesiculobullous	Epidermolytic hyperkeratosis
Spongiotic	Cornoid lamellation
Interface dermatitis (Vacuolar, Lichenoid)	Papillomatosis
Granulomatous	
Vasculitis	
Fibrosing dermatitis	
Panniculitis	

Table 2: Suggested method for reading the slide of a skin biopsy specimen.

1. Identify the haematoxylin and eosin-stained section of skin having epidermis, dermis and subcutaneous fat (mention if any special stain used). Always keep the epidermis on top.
2. Identify the anatomic site of biopsy specimen (as certain conditions are site specific).
3. Identify the basic pathology: whether it is inflammatory or neoplastic.
4. If inflammatory, figure out the basic tissue reaction pattern and look for additional findings. If neoplastic, see if the origin is epithelial or non-epithelial (neural, fibrous, muscle, vascular, metastatic, etc.,).
5. View all sections in a given slide so as to confirm a finding/not to miss any finding.
6. List all the microscopic findings and mention diagnosis/ differentials.
7. Correlate clinically to give the final diagnosis.

Table 3: Template to step-wise examining of a skin biopsy section and some examples of possible findings in each layer.

Layer of skin	Possible findings
Stratum corneum	• Type of stratum corneum – Basket weave/Laminated/Compact • Orthokeratosis/Parakeratosis (Type of parakeratosis) • Munro's microabscess in Psoriasis • Organisms – Dermatophytes, Candida, Malassezia • Plasma globules, crust in eczema • Detached stratum corneum in subcorneal blistering disorders
Stratum granulosum	• Thickness – Normal/Hypogranulosis (Psoriasis)/Hypergranulosis (Wedge shaped in lichen planus) • Look for keratohyalin granules • Granular layer acantholysis (Pemphigus foliaceus)
Stratum spinosum	• Acanthosis/Atrophy • If acanthosis- Regular/Irregular/Adnexal/Pseudoepitheliomatous • Spongiform pustule of Kogoj in psoriasis • Spongiosis in eczemas • Corps ronds in Darier's disease • Epidermolytic hyperkeratosis • Loss of polarity of keratinocytes in Bowen's disease • Exocytosis (of inflammatory cells) • Epidermotropism • Civatte bodies
Stratum basale	• 'Row of tombstone' appearance in Pemphigus vulgaris • Vacuolar interface change • Melanocytes- Normal/Increased/Absent
Dermo-epidermal junction	• Thickened basement membrane in lupus erythematosus • Subepidermal blister
Papillary dermis	• Grenz zone • Colloid bodies • Melanophages (Pigment incontinence) • Dilated capillaries (Psoriasis, Warts) • Superficial perivascular infiltrate (mild, moderate, dense), arrangement (band- like nodular, coat sleeve pattern, curvilinear) and composition of infiltrate. • Small vessel vasculitis • Amyloid deposits • Granulomas • Necrosis • Organisms
Reticular dermis	• Deep perivascular/periadnexal/interstitial infiltrate • Collagen (Fibrosis/Sclerosis/Keloidal/Necrobiotic) • Adnexal structures (Hair follicles, eccrine glands, apocrine glands)
Subcutaneous tissue	• Septal panniculitis (Classical example- Erythema nodosum) • Lobular panniculitis (Classical example- Erythema induratum) • Medium vessel vasculitis

(what and when to biopsy using appropriate biopsy technique), handling conventional microscope, definitions of basic dermatopathology terminologies, identification of normal skin histology and site-specific normal histology. For example, the presence of multiple folliculosebaceous units and skeletal muscle in biopsies from head-and-neck region, thick stratum corneum and presence of Meissner's corpuscles on palms and soles, thick dermis on the back, thickened upper dermal blood vessel walls in biopsies from distal lower limbs due to upright posture and long-standing stasis, peculiarities of mucosal epithelium like lack of stratum corneum and granulosum, lack of distinction between papillary and reticular dermis and absent adnexa, etc.

The slide should first be viewed at scanner magnification (objective ×2 or ×4), followed by assessment of details at higher magnifications (objective ×10, ×20 and ×40) to

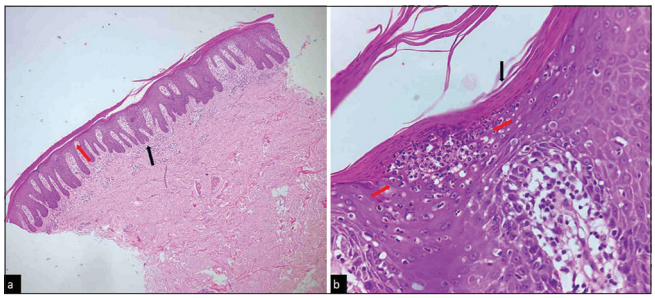

Figure 2: Plaque psoriasis. (a) Parakeratotic compact stratum corneum, acanthosis in the form of regular club-shaped elongations of rete ridges, described as camel foot appearance (black arrow), suprapapillary thinning (red arrow), superficial perivascular moderate infiltrate [Haematoxylin and eosin (H and E), x100], (b) High power of spongiform pustule of Kogoj in upper spinous layer showing neutrophils along with spongiosis, resembling a sponge (between red arrows). Also note the lack of granular layer and flat parakeratosis (black arrow) (H and E, ×400).

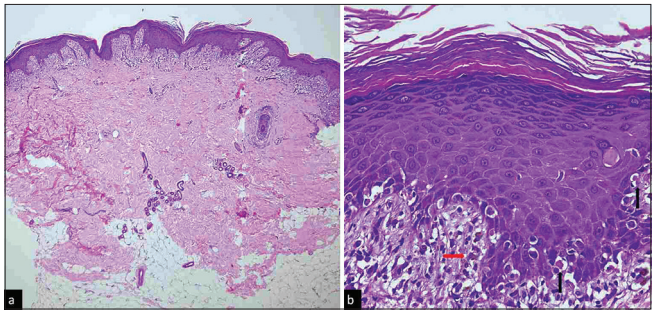

Figure 3: Lichen planus. (a) Compact ortho-hyperkeratosis, wedge-shaped hypergranulosis, mild acanthosis with saw-toothing of rete ridges due to damage to basal keratinocytes, upper dermal band-like moderately dense infiltrate [Haematoxylin and eosin (H and E), x40], (b) Wedge-shaped hypergranulosis, basal cell damage with multiple pink globular bodies along basal layer called colloid bodies (black arrows) and melanophages (red arrow) (H and E, ×400).

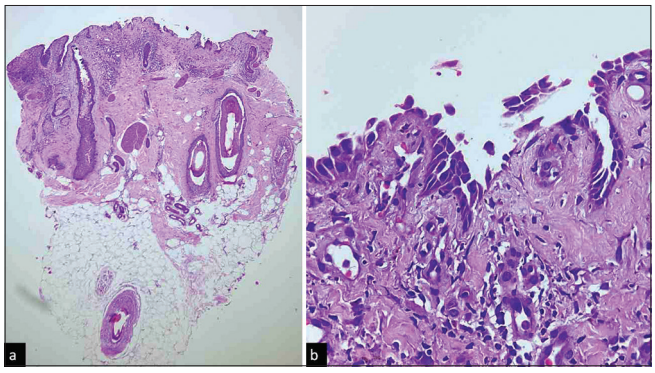

Figure 4: Pemphigus vulgaris. (a) Epidermis is lost due to suprabasal clefting and only the basal layer is seen. Note the suprabasal clefting extending into the hair follicles. Moderately dense upper dermal perivascular infiltrate is seen [Haematoxylin and eosin (H and E), x40], (b) Basal layer showing 'row of tombstone' appearance with basal keratinocytes separated from each other but attached to the basement membrane (H and E, ×400).

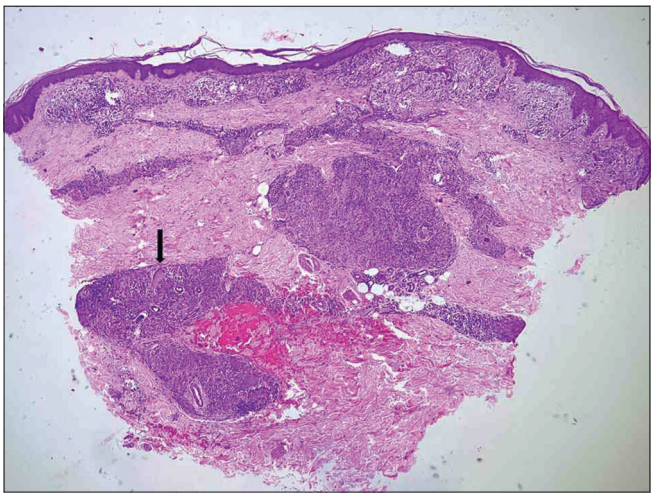

Figure 5: Borderline tuberculoid Hansen's disease. Thin flat epidermis with upper and mid-lower dermis showing multiple well circumscribed, sinuous, oblong, curvilinear infiltrate around adnexa and neurovascular bundles, referred to as leprosy pattern. Multiple Langhans' giant cells (black arrow), epithelioid cells and lymphocytes are seen [Haematoxylin and eosin (H and E), x40].

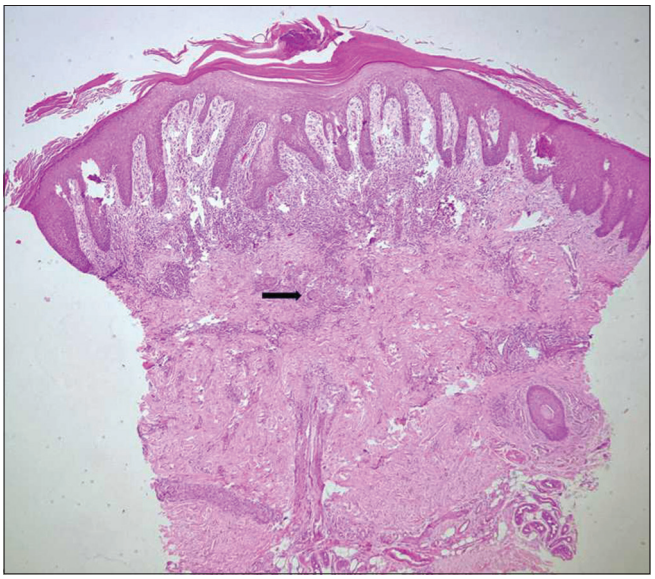

Figure 6: Lupus vulgaris. Irregular epidermal hyperplasia with hyperkeratosis and focal parakeratosis, upper dermal lichenoid granulomatous infiltrate and discrete epithelioid granulomas with giant cells (black arrow) in mid-lower dermis with intervening dermis showing areas of fibrosis [Haematoxylin and eosin (H and E), x40].

confirm the findings further and delineate the composition of inflammatory infiltrate. All findings must be noted, from top (stratum corneum/epidermis) to bottom (deep dermis/subcutaneous fat). The importance of scanner view cannot be overemphasised, it indeed provides a bird's eye view of the whole specimen and helps to identify the site (epidermal, dermal or subcutaneous) as well as the nature of the underlying pathology. Next step is identification

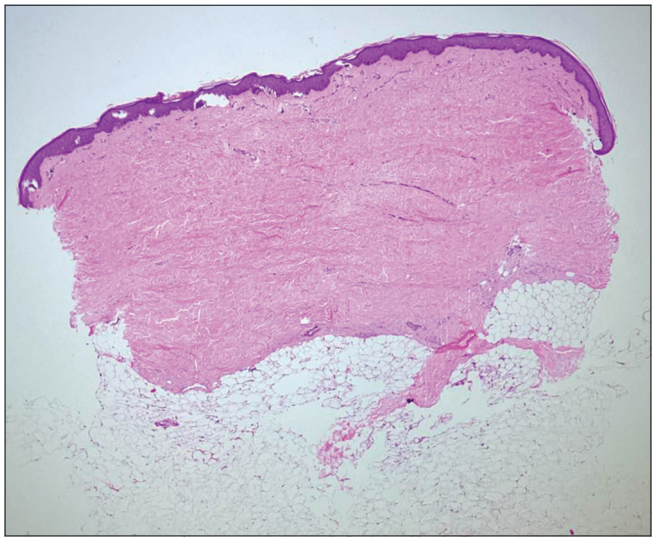

Figure 7: Morphoea with prominent sclerosis of collagen in dermis and absence of adnexal structures. Note the squared edges of the biopsy specimen. Compare the sclerosed collagen of morphoea with normal reticular collagen in Figure 1. [Haematoxylin and eosin (H and E), x40].

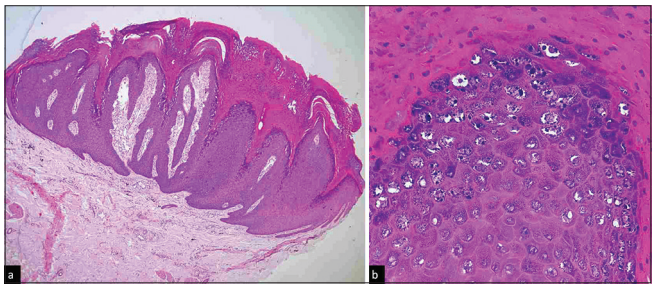

Figure 8: Verruca vulgaris. (a) Papillomatosis with prominent incurving of rete ridges at both the sides, hyperkeratosis with parakeratotic columns at the summit of papillary elongations and underlying hypogranulosis. Dilated blood vessels in papillary dermis and presence of blood in stratum corneum are important findings in wart [Haematoxylin and eosin (H and E), x100], (b) Upper epidermal keratinocytes showing human papillomavirus (HPV) virus induced cytopathic changes in the form of prominent coarse keratohyaline granules, basophilic cytoplasmic inclusions, shrunken nucleus (koilocytes). Also note the stubby parakeratosis (H and E, ×400).

of major and/or minor reaction pattern seen [Table 1]. Further, with regular practice and diligent examination of microscopic findings, the basic pathology can be identified and differentials/specific diagnosis can be generated. Suggested method for assessment of a section of skin has been elaborated in Table 2. A template for noting down the findings with some examples has been tabulated in Table 3. It would be meaningful if a resident or trainee is able to correctly identify and analyse all the histopathological findings, followed by categorising them as diagnostic/additional/incidental/unusual, so as to generate histologic

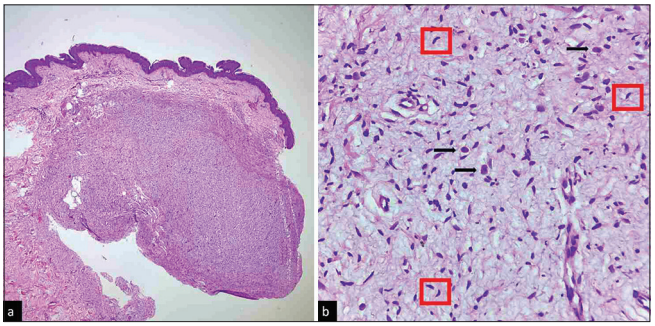

Figure 9: Neurofibroma. (a) A dermal fairly well-defined non-encapsulated tumour composed of spindle cells [Haematoxylin and eosin (H and E), ×40], (b) High magnification showing loosely arranged Schwann cells with characteristic S-shaped wavy nucleus with tapering ends (also described as buckled nucleus with slight bent in centre, resembling 'diving dolphins') (red boxes), along with mast cells with characteristic fried egg appearance (black arrows). Note the loose myxoid stroma (H and E, ×400).

Table 4: Suggested reads for dermatopathology.

Books	• Ackerman's Histologic diagnosis of inflammatory skin diseases (Ackerman AB, Boer A, Bennin B, Gottlieb GJ, editors, 3rd ed.., 2005) • IADVL Textbook of Dermatopathology (Ramam M, Khandpur S, Bhari N, Gupta V, editors. 1st ed.., 2023) • Lever's Histopathology of skin (Elder DE, editors. 12th ed..ition, 2022) • Weedon's Skin Pathology (Patterson JW, editors, 5th ed..ition, 2021) • McKee's Pathology of the Skin with Clinical Correlations (Calonje E, editors. 5th ed..ition, 2019) • Fundamentals of Pathology of skin (Venkataram M, Editors, 4th ed.., 2015)
Journals	• American Journal of Dermatopathology • Journal of Cutaneous Pathology • Dermatopathology • Indian Journal of Dermatopathology and Diagnostic Dermatology
Online	• Teaching videos (Online Training Module) on IADVL website • Digital histopathology library of 40 common slides on IADVL website • Webinars conducted by IADVL Academy

IADVL: Indian Association of Dermatologists, Venereologists and Leprologists

Table 5: Commonly asked dermatopathology cases in practical examinations.

Category	Conditions
Psoriasiform tissue reaction pattern	Psoriasis (Variants – Pustular psoriasis, Palmoplantar psoriasis) Pityriasis rubra pilaris
Spongiotic tissue reaction pattern	Acute, subacute, chronic eczema
Lichenoid tissue reaction pattern	Lichen planus (Variants – Hypertrophic lichen planus, Lichen planus pigmentosus, Lichenoid drug eruption) Lichen nitidus Fixed drug eruption/Stevens–Johnson syndrome/Toxic epidermal necrolysis Erythema multiforme Lupus erythematosus Pityriasis lichenoides
Vesiculobullous tissue reaction	Subcorneal blister (Pemphigus foliaceus) Intraepidermal blister (Pemphigus vulgaris, Hailey–Hailey disease, Darier's disease) Subepidermal blister (Bullous pemphigoid, Dermatitis herpetiformis, Linear IgA disease)
Granulomatous tissue reaction	Infective (Lupus Vulgaris/Tuberculosis verrucosa cutis, Hansen's disease) Non-infective (Sarcoidosis, Granuloma annulare, Foreign body granuloma)
Vasculitis tissue reaction	Small vessel vasculitis (Leucocytoclastic vasculitis)
Panniculitis	Erythema nodosum Erythema induratum
Epidermal reaction pattern	Epidermolytic hyperkeratosis Cornoid lamella (Porokeratosis) Perforating dermatoses (Reactive perforating collagenosis) Papillomatosis (Epidermal nevus, Nevus sebaceous, Verruca, Seborrheic keratosis)
Infections	Fungal (Dermatophytosis, Mycetoma, Chromoblastomycosis, Histoplasmosis) Viral infections (Verruca vulgaris, Plane wart, Condyloma acuminata, Epidermodysplasia verruciformis, Molluscum contagiosum)
Cutaneous lymphoma	Mycosis fungoides
Deposition disorders	Amyloidosis Calcinosis cutis
Cysts	Epidermoid cyst Trichilemmal/Pilar cyst Steatocystoma
Tumours	Seborrheic keratosis Basal cell carcinoma Bowen's disease/Squamous cell carcinoma Paget's disease Trichoepithelioma Neurofibroma Dermatofibroma/Dermatofibrosarcoma protuberans
Miscellaneous	Cicatricial alopecia (Lichen planopilaris, Discoid lupus erythematosus) Non-cicatricial alopecia (Alopecia areata) Mucosal biopsy (Pemphigus vulgaris, Lichen planus) Nail biopsy (Psoriasis, Lichen planus, Onychomycosis) Morphoea/Lichen sclerosus Hypertrophic scar/Keloid Pyogenic granuloma Melanocytic nevus (Junctional, Dermal, Compound)
Special stain	Fite-Faraco stain for lepra bacilli in Hansen's disease PAS stain, GMS stain–Fungus PAS- Thickened basement membrane Masson's trichrome stain - Blue green collagen in perforating disorder

PAS: Periodic acid-Shiff, GMS: Gomori methenamine silver

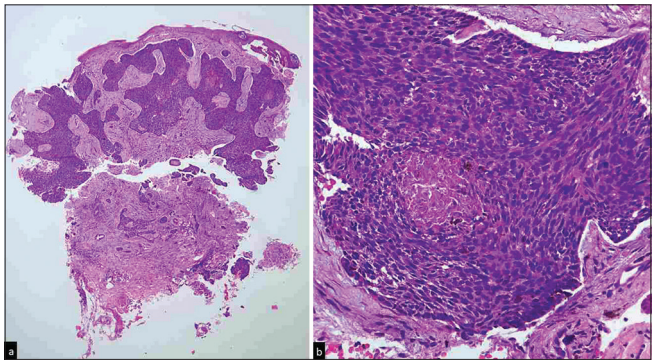

Figure 10: Basal cell carcinoma. (a) Multiple irregular tumour islands composed of basaloid cells with peripheral palisading and prominent retraction artefact between tumour nodules and mucinous stroma [Haematoxylin and eosin (H and E), x40], (b) The tumour cells have deeply basophilic large oval elongated nucleus and scant cytoplasm. Note the eosinophilic amorphous area of necrosis in the centre of the tumour nodule (H and E, ×400).

differentials. It is advised first to see the slide with an open mind (without the clinical details), followed by clinical correlation to reach a specific diagnosis. Such an approach shall not only teach detailed histological examination but also enable to learn the art of clinicopathological correlation, which is indispensable in dermatology. Suggested reading material in dermatopathology has been summarised in Table 4. Some commonly asked cases in practical examinations have been compiled in Table 5 and classical photomicrographs of some of these cases have been shown in Figures 1-10.

CONCLUSION

It is well known that histological findings are dynamic and correspond to the chronology or the stage at which the lesion is biopsied (evolving, fully developed and resolving). Most of inflammatory dermatoses lack a gold-standard diagnostic histologic criterion (except in infective conditions, where demonstration of organism is gold-standard diagnosis) and clash of criteria often occurs. We must be open to such scenarios and practically see under the microscope how real-life histologic findings vary with the conventional textbook teaching and attempt to ascertain best possible diagnosis based on clinicopathological correlation. Dermatopathology training during residency is, therefore an opportunity to get ample 'hands-on' training in viewing and interpreting the slides and understand the importance as well as limitations of histopathology.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Nil.

Conflicts of interest

Dr. Geeti Khullar is on the Editorial Board of the Journal.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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