The Skin (Integument): PART I

39

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Dermatological conditions (dermatoses) are common and are often an under appreciated source of morbidity. Patients may present to a variety of healthcare providers including the emergency department, with a range of acute skin complaints. Most dermatological emergencies are comparatively rare and when they occur, they are unlikely to affect the head and neck area in isolation. However, involvement of the head and neck may be the first or only indication as to the serious nature of the dermatosis. For example, if a patient presents with a rapidly progressing rash, mucosal and conjunctival involvement may indicate Stevens Johnson syndrome (an uncommon but severe immune complex mediated hypersensitivity reaction, that typically involves both the skin and the mucous membranes). Therefore, it is important to be aware of both common and serious dermatoses, their initial treatments and be familiar with local referral protocols.

Embryologically, skin develops from three sources

1. The epidermis is ectodermal in origin
2. The dermis is mesodermal in origin
3. The melanocytes arise from the neural crest

Initially, the epidermis is comprised of a single layer. However, it divides to form a superficial flattened cell layer called the epitrichium. Proliferation of the basal (germinal cells) results in multiple layers. At the end of the fourth month of intrauterine life the epidermis is fully formed, as described later. Due to this rapid proliferation, the epidermis becomes stratified. Shedding of the superficial cells can become mixed with the secretions of the sebaceous glands to form a greasy, whitish substance known as vernix caseosa. This covers the delicate skin of the newborn,

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protecting it. The dermis develops from mesenchyme derived from the somatic dermatome. The junctional zone between the epidermis and the dermis is initially straight, but as the epidermis thickens, projections pass into the dermis. The part of the dermis between the two epidermal projections is called the dermal papilla. Melanoblasts are derived from neural crest cells that migrate into the basal layer of the epidermis. They differentiate into melanocytes by mid-pregnancy, when melanosomes can be seen. Langerhans cells are derived from the bone marrow (mesoderm) and migrate into the epidermis. They are involved in antigen presentation. Merkel cells are of uncertain origin. They are associated with free nerve endings and possibly function as mechanoreceptors.

39.1 Applied Anatomy and Physiology

The skin is the largest organ of the body, accounting for about 15% of its total weight (in a non-obese adult). It performs many important functions, including (1) protection from the environment, (2) prevention of excess water loss (3) thermoregulation, (4) excretion of toxic substances (5) immunological (6) sensory and (7) Vitamin D synthesis. Skin is continuous with the mucous membranes lining the body's surface. The term "Integumentary system" is sometimes used to refer to the skin and its derivatives. Adult skin is composed of three layers (1) the epidermis, (2) the dermis and (3) subcutaneous tissue. The outer most layer, the epidermis, consists of specific cells known as keratinocytes, which function to synthesise keratin, a protective protein. The middle layer, the dermis, is mostly composed of collagen, a structural protein. Defects in collagen synthesis can result in a wide range of clinical features, including excessive skin laxity. The epidermis and dermis overlay the subcutaneous tissue (panniculus), which contains locules of fat cells, known as lipocytes. The thickness of all three layers varies considerably, depending on their site. Eyelid skin for example is the thinnest skin in the body, with an epidermis less than 0.1 mm (compared to up to 1.5 mm on the palms and soles of the feet).

39.1.1 Epidermis

The epidermis is a multi-layered structure (stratified squamous epithelial layer) that is composed mostly of two types of cells—keratinocytes and dendritic cells. Other cells include melanocytes, Langerhans cells and Merkel cells. The epidermis is often divided into five layers according to keratinocyte morphology, position and differentiation. These are the (from deep to superficial)

1. Basal cell layer (stratum germinativum)
2. Squamous cell layer (stratum spinosum),
3. Granular cell layer (stratum granulosum)
4. Lucidum cell layer (stratum lucidosum) and the
5. Cornified, or horny cell layer (stratum corneum)

The lower three layers, which contain living nucleated cells are sometimes referred to as the stratum malpighii and rete malpighii. The epidermis is a continually renewing protective structure. Cells are generated in the basal layer and gradually become more superficial. Skin also gives rise to a number of structures, such as the pilosebaceous apparatus, nails and sweat glands.

39.1.1.1 Keratinocytes

At least 80% of the cells in the epidermis are keratinocytes. As they migrate from the basal layer to the surface of the skin they undergo keratinisation. This involves a synthetic phase (where the cell accumulates keratin in the cytoplasm), and a degradative phase (where cellular organelles are lost and cell contents become consolidated into a mixture of filaments and amorphous structures—to finally become a horny cell or corneocyte). This takes around 14 days to occur.

39.1.1.2 Basal Layer

This layer contains column-shaped keratinocytes that are vertically arranged and attached to the basement membrane zone. These cells form a single adherent layer (via desmosomal junctions). The basal layer is the main site for cell replacement. However, not all basal cells have the potential to divide. Epidermal stem cells are "clonogenic" cells that normally go through the cell cycle very slowly. This can be accelerated following wounding. DNA damage from carcinogens and irradiation (sunlight) can also mutate these cells and adversely affect their behaviour.

39.1.1.3 Squamous Cell Layer

Overlying the basal cell layer is the squamous cell layer. This is composed of a variety of cells that differ in shape, structure, and properties depending on their location. Many contain 'granules', which are intracellular organelles containing glycoproteins, glycolipids, phospholipids, and a range of acid hydrolases (lipases, proteases, acid phosphatases, and glycosidases). The spaces between these cells are bridged by abundant desmosomes that provide structural support and resistance to minor trauma. Gap junctions between these cells create an intercellular pore, enabling chemical communication between the cells. This is important in order to maintain regulation of cell metabolism, growth and differentiation.

39.1.1.4 Granular Layer

This is the most superficial layer of the epidermis which contains viable cells. It is composed of flattened cells containing abundant keratohyaline granules. This layer varies in thickness along with the overlying cornified layer. A very thin or absent granular layer can result in extensive parakeratosis (in which the nuclei of the keratinocytes persist when the cells move into the stratum corneum). This is seen in psoriasis.

39.1.1.5 Lucidum layer

The stratum lucidum is composed of three to five layers of dead flattened keratinocytes. These cells do not show distinct boundaries and are filled with Eleidin, an intermediate form of keratin. They are surrounded by an oily substance.

39.1.1.6 Cornified Layer

The outermost corneocytes in this layer provide much of the skin's mechanical properties and prevent water loss. These cells are rich in protein and low in lipid and are surrounded by an extracellular lipid matrix. They are essentially dead cells having lost their nuclei during their "terminal differentiation". These are gradually shed from the skin.

39.1.1.7 Regulation of Proliferation and Differentiation

During proliferation and differentiation the epidermis needs to maintain a relatively constant number of cells to prevent both atrophy and hypertrophy. This is regulated in part by the underlying dermis, which plays an important role in the maintenance of structure and function. The epidermal-dermal interface is also an important site in the development of epidermal appendages. Maintenance of a constant epidermal thickness depends also on a number of intrinsic properties of the epidermal cells, including the ability to undergo apoptosis (programmed cell death). This is important in both regulating cell numbers and in the defence against virus-infected or other damaging factors. Apoptosis is regulated by "signaling molecules" (hormones, growth factors and cytokines). Disruption of this process can result in skin disorders such as psoriasis. Loss of regulation of apoptosis can result in tumours.

39.1.1.8 Melanocytes

These are pigment synthesising cells that are embryologically derived from the neural crest. They are confined predominantly to the basal layer, with branching processes that pass superficially between the keratinocytes. Melanocytes are responsible for the production of the pigment melanin. This is produced in tiny membrane-bound organelles, called melanosomes. The melanosomes are then moved to the end of the melanocytic processes, where they are transferred to the keratinocytes. Thus skin becomes pigmented. Depending on the rate of production skin colour can vary both within and between individuals. Heavily pigmented skin occurs as a result of greater production of melanosomes, each containing more melanin, plus a slower rate of degradation compared to fair skin. Ultraviolet light stimulates this process, resulting in tanning of the skin. This increases the cell's ability to absorb sunlight and protect its DNA from radiation-induced mutations.

39.1.1.9 Merkel Cells

These are mechanoreceptors which are located in sites of high tactile sensitivity such as the fingers, lips, oral cavity and hair follicles. They are attached to the basal keratinocytes and are sometimes arranged into specialised structures known as 'tactile discs' or 'touch domes'. Deformation of the adjacent cells causes the Merkel cells to release a chemical signal, that stimulates its attached sensory neurone.

39.1.1.10 Langerhans Cells

Langerhans cells are derived from the bone marrow and are antigen-presenting cells, involved in a variety of T-cell responses. During embryonic development they migrate to the basal layer where they circulate and repopulate the epidermis throughout life, reportedly maintaining nearly constant numbers. They do not form cellular junctions with neighbouring cells. The cells are mostly found in the squamous and granular cell layers. Exposure to an antigen results in a complex process which culminates in the stimulation of T cells and their migration.

39.1.2 The Dermal-epidermal Junction

This junction is formed by a porous basement membrane zone. This holds the epidermis and dermis together, whilst at the same time acting as a semipermeable layer, enabling the exchange of cells and fluid. The basal keratinocytes are the most important components of this junction, although other cells contribute (dermal fibroblasts). The basal lamina of the basement membrane is synthesised by the basal cells and consists mostly of type IV collagen. The basal cells themselves are attached to the lamina by rivet-like hemidesmosomes, which provide mechanical support and attachment for the epidermis.

39.1.3 Epidermal Appendages (Adnexa)

The skin adnexa are a group of ectodermally derived appendages, which includes eccrine and apocrine glands, ducts and pilosebaceous units. Embryologically, these develop as a result of downgrowths from the epidermis. All are therefore capable of re-epithelialising the skin in response to its loss. Thus areas such as the face and scalp, which contain large numbers of pilosebaceous units, can rapidly re-epithelialise compared to other sites below the collar bones.

39.1.3.1 Eccrine Sweat Glands

Eccrine sweat glands are ductal structures that are involved in temperature regulation. They are mostly found on the soles of the feet and least on the back. The secretory part of the gland lies deep in the dermis or the superficial panniculus and is composed of glycogen-rich clear secretory cells and specialised myoepithelial cells. The glycogen-rich cells initiate the production of sweat. This is initially isotonic, but further actively reabsorbs sodium, resulting in secretion of a hypotonic solution onto skin surface.

39.1.3.2 Apocrine Sweat Glands

Apocrine glands are involved in scent release and are confined mainly to the axillae and perineum. They do not open directly to the skin surface, but rather into the pilosebaceous follicles. These glands become active just before puberty, producing a secretion with a distinct odour which functions as a territorial marker, warning signal and sexual attractant.

39.1.3.3 Hair Follicles

Hair has many important functions including thermoregulation (less so in humans), protection and distribution of sweat-gland products. Hair follicles vary considerably in size and shape depending on their location, but they all have the same basic structure. During embryogenesis, mesenchymal cells in the foetal dermis cluster below the basal layer of the epidermis. This stimulates the overlaying basal cells to grow downwards at an angle into the dermis, to form the follicle. This finally widens at the base to form a bulb around the mesenchymal cells, which themselves become the dermal papilla. In some respects this is analogous to the early stages of tooth embryogenesis as described in the chapter on the mouth.

Sebaceous glands, apocrine gland and the attachment for the arrector pili muscles all form from the foetal hair follicle by a budding process. The arrector pili are smooth muscle fibres attached to the root sheath of the follicle. Rapidly proliferating cells in the hair bulb produce the hair shaft. Hair growth occurs in a cyclical manner (anagen, catagen and telogen), but each follicle functions independently of the others. This is regulated by insulin-like growth factor 1 and fibroblast growth factor 7 under the influence of various hormones (testosterone, oestrogen, thyroid, glucocorticoids, retinoids, prolactin and growth hormone). Hair colour is determined by the distribution of melanosomes in the hair shaft. As we get older the number of melanocytes declines, resulting in greying of the hair.

39.1.3.4 Sebaceous Glands

Sebaceous glands are found in greatest number on the face and scalp but are present many other parts of the body. These produce abundant lipid secretions (sebum) which is then released into the hair follicle. This is why hair can become ‘greasy’ if it is not washed regularly.

39.1.4 Dermis

This is a complex layer of predominantly connective tissue, containing neural and vascular networks, the skin appendages, fibroblasts, macrophages, mast cells, lymphocytes and plasma cells. Embryologically it is mesodermal in origin, except for the nerves which are derived from the neural crest. The dermis comprises the bulk of the skin and provides its pliability, elasticity and strength. Its major component is type I collagen, together with elastic fibres. Collagen has a tensile strength similar to steel, but also has much higher flexibility. Hyaluronic acid is a mucopolysaccharide comprising a small part of normal dermis. This can accumulate in some pathologic conditions and is the main constituent in some injectable ‘fillers’, commonly used in the cosmetic industry. The dermis thus acts to protect the body from mechanical injury, bind water and aid thermal regulation and sensory stimuli. Both the dermis and epidermis interact during development and in the healing process following trauma.

The dermal vasculature is generally made up of two intercommunicating plexuses (1) the subpapillary or superficial plexus (composed of postcapillary venules) and (2) the lower plexus at the dermal-subcutaneous interface. Blood flow in human skin fluctuates significantly. Vasoconstriction, vasodilation and sweating are important in

thermoregulation. Involuntary (smooth) muscle in the skin is found in various sites. Striated (voluntary) muscle is found in the skin of the neck (the platysma) and in the skin of the face. The superficial muscular aponeurotic system is an intricate network of muscle, fascia and aponeuroses that connects these muscles to the parts that they move. Skin lymphatics parallel the blood supply and function to conserve plasma proteins and remove foreign material, antigenic substances and bacteria. Blind-ended lymphatic capillaries arise within dermal papillae. These are valveless and superficial and drain into deeper, valved dermal and subdermal plexi. These then coalesce to form larger lymphatic channels, which course through numerous filtering lymph nodes on their way to join the venous circulation at the root of the neck (thoracic and lymphatic ducts).

39.1.5 Subcutaneous Fat (Panniculus Adiposus)

Embryologically, toward the end of the fifth month fat cells begin to develop in the subcutaneous tissue. These are separated by fibrous septa comprised of collagen and blood vessels. Subcutaneous tissue functions as a reservoir for energy. Hormone conversion takes place converting androstenedione into oestrone. Lipocytes also produce leptin, a hormone that regulates body weight. It is therefore considered by some specialists to effectively be an endocrine organ.

39.2 Nomenclature in Dermatoses

Understanding the descriptive terminology used by dermatologists and other professionals is important. This allows accurate communication between medical personnel and is the framework upon which many dermatological diagnoses are made. Unfortunately, an isolated description of a lesion's colour is rarely helpful on its own—a "red" or "red-brown" lesion is insufficient to make a diagnosis. Other descriptive qualities are needed. Most lesions can be described a being composed of the "Primary" lesion, with or without secondary features.

39.2.1 Primary Lesion

39.2.1.1 Flat Lesions

Macule: a small (<1 cm) flat, non-palpable circumscribed area of change in skin colour.

Patch: larger (>1 cm), non-palpable circumscribed area of change in skin colour (Fig. 39.1).

39.2.1.2 Solid Raised (Palpable) Lesions

Papule: a raised, palpable lesion <0.5 cm in diameter.

Nodule: a raised, palpable lesion ≥0.5 cm in diameter.

Plaque: a raised, palpable lesion usually flat-topped and greater than 2 cm in diameter.

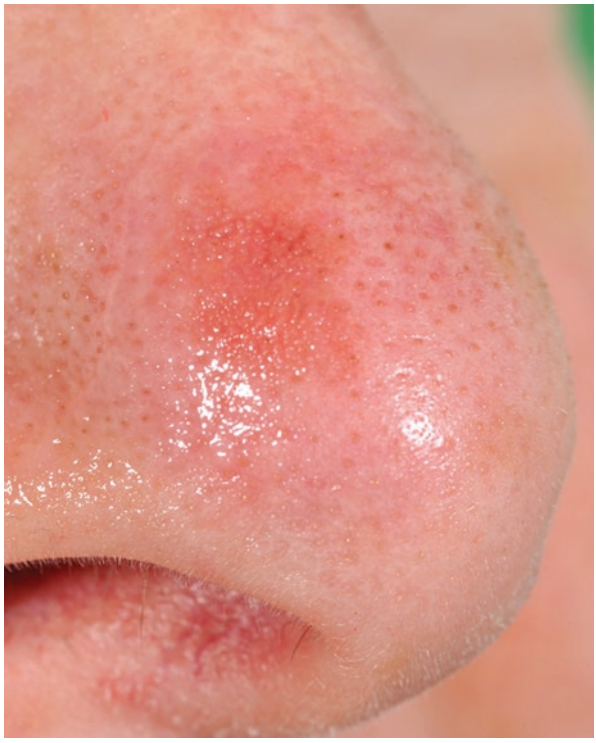

Fig. 39.1 Macule

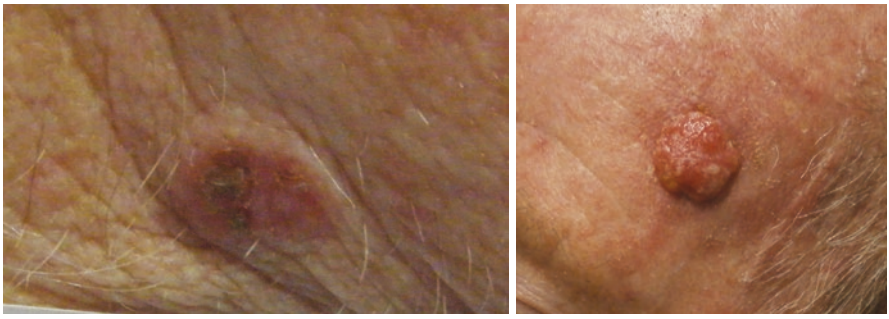

Fig. 39.2 Nodules

Weal (or wheal): a transient raised area of epidermal/dermal oedema (a rash consisting of these lesions is described as urticarial or urticated).
Comedone: a plug of keratin or sebum in a distended skin pore (Fig. 39.2).

39.2.1.3 Fluid Filled Lesions

Vesicle: an elevated fluid filled lesion <0.5 cm in diameter (contains clear fluid).
Bulla: an elevated fluid filled lesion ≥0.5 cm in diameter (contains clear fluid).

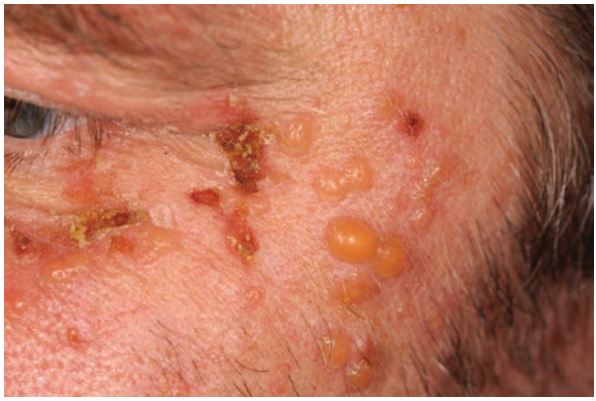

Fig. 39.3 Multiple vesicles

Pustule: an elevated fluid filled lesion usually <0.5 cm filled with purulent fluid (Fig. 39.3).

39.2.1.4 Depressed Lesions

Erosion: loss of the outer layers of the epidermis. Because these are superficial and do not involve connective tissue (the dermis), healing occurs without scarring.

Ulceration: loss of the full thickness of the epidermis with extension into the dermis. These deeper lesions have a great chance of healing with scarring.

Fissure: a linear crack in the epidermis, usually secondary to skin dryness and loss of elasticity.

39.2.2 Secondary Features

Crusting: dried serum/exudate, forming a roughened brown-yellow outer layer.

Scaling: a flat plaque of adherent keratinocytes. This is usually dry and flaky.

Excoriation: exogenous damage to the epidermis (often caused by scratching).

Lichenification: protective skin thickening with exaggeration of skin creases (usually in response to repeated trauma).

Sclerosis: induration (firmness on palpation) of the subcutaneous tissue.

Atrophy: loss of tissue from the epidermis, dermis or subcutis (Figs. 39.4, 39.5 and 39.6).

39.3 The Dermatological Diagnostic Approach

The diagnostic approach to skin disease follows the same principles as other branches of medicine—a careful history is followed by a focused clinical examination. Dermatology differs somewhat from other specialties, as diagnostic pathological changes are often visible to the unaided eye. Therefore much more emphasis is placed on clinical examination. Indeed many lesions are often self-evident on close

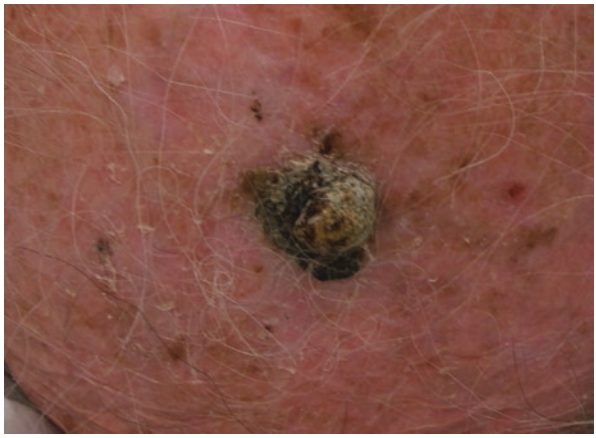

Fig. 39.4 Scaling

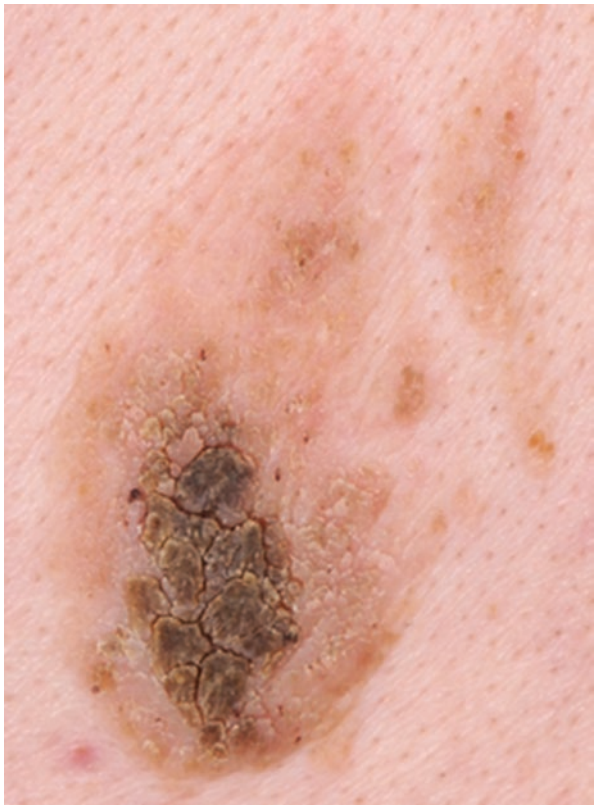

Fig. 39.5 Scaling

inspection. This is not to say that a clinical history is unimportant and can be omitted. A history of change for example, may be the only indication that the lesion is malignant, notably in melanoma. With practice and experience, diagnoses can be made quickly with targeted questioning and pattern recognition.

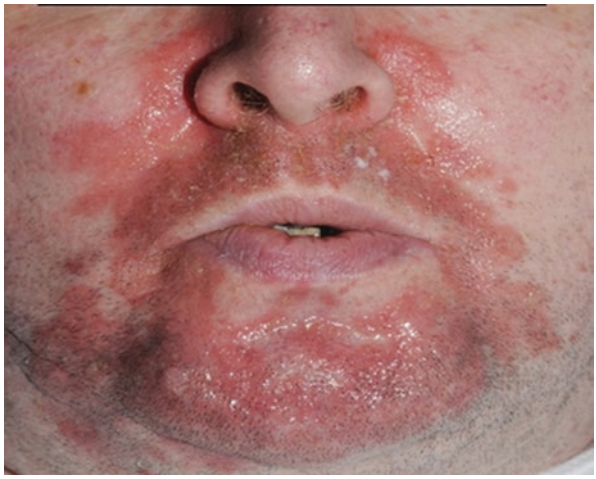

Fig. 39.6 Crusting

39.3.1 Important Considerations When Taking a History

This is very similar to other branches of medicine and is largely based on being thorough, focused and using common sense. If a rash is present you need to know where and how it began, where it sequentially spread to and how long this took. Rashes may be episodic rather than constant. If so, enquire as to how many episodes have occurred, how long they last and the interval between episodes. The initial morphology of the rash at onset may not necessarily be similar to its current appearance. This may have been altered by treatment, or the nature of the rash may have changed as part of the disease process. In such cases a previous description, or preferably photographs, at the time of onset are invaluable. Additionally, whether the rash was symptomatic with itch, pain, tenderness or weeping may help narrow the differential diagnosis.

Aggravating and relieving factors are also important to note and may be helpful in diagnosis. Rosacea for example, is exacerbated traditionally with sunlight exposure. If present, note the interval between exposure to any aggravating or relieving stimulus and the subsequent response. Enquire as to whether there is any relationship between the severity of the rash and the patient's employment—occasionally dermatoses may be occupational in nature. Consider also the patient's past medical history, focusing upon previous rashes, atopic diseases both past and present (which may be associated with eczema) and any potential allergies or sensitivities. Some dermatoses tend to cluster in families so enquire as to whether or not any other family members are affected.

Explore any previous treatments to date, in particular focus on any previous attendances to a general physician or dermatologist, whether any histological or microbiological investigation was performed and if so the outcome. If treatments were applied, determine how they were procured, how they were applied and the quantity used. In the case of topical treatments this is best performed by stipulating a specific quantity over a period of time rather than an estimate of thickness of application.

Explore the patient's medication history. Some rashes may be precipitated or aggravated by drugs. Focus upon the timing of any new medications started around the same time as the development of the rash. Finally, in the case of suspected skin cancer assess previous sun exposure by enquiring about the frequency of foreign holidays, frequency of sunbed use, how often sunscreen is applied, the number of episodes of burning and how the patient's skin responds to sunlight (easily tanning, burning then tanning or just burning). Enquire also about previous skin cancers personally or within the family.

39.3.2 Examining the Skin and Associated Structures

As with other branches of medicine, clinical examination in dermatology is composed of inspection and palpation. This should be performed in a well-lit environment at a comfortable room temperature. When necessary, the entire body surface may need to be inspected in a step wise process to ensure that diagnostic clues or incidental findings beyond the head and neck are not overlooked. A cover or gown will allow the patient to maintain his or her dignity. When examining any intimate areas, remember it is essential that a chaperone is present. When lesions present in the head and neck it is important to include the mucous membranes of the eyes, nose and mouth in the examination. This aspect of the examination is discussed in detail in their respective chapters. Of note, inspect the buccal mucosa, gingiva, palate and under surface of the tongue. Examine the often forgotten areas of the pinna, the external auditory canals and the post-auricular region. Finally, examination of the scalp must be meticulous, especially if the hair is long or thick. If necessary trim the hair over any suspicious area (get consent from the patient first). Examination of individual hair follicles is largely unrewarding—the pathology in hair loss is most commonly found affecting follicular structures within the dermis and so cannot be seen.

39.3.2.1 Inspection

Note the type of primary lesion (described previously) and whether any secondary changes are present. If there is more than one primary lesion, note the size of each, how well defined they are and any pattern or grouping. The exact number of lesions is rarely helpful, counting each one is usually unnecessarily onerous. It is much more useful to describe the extent of a rash in terms of body surface area. Body surface area charts are in existence already for assessment of burns patients and should be accessible.

It is important to remember that sometimes, two or more distinct types of lesion may be present. In a rash this is described as 'polymorphic'. For example, some rashes may be at varying stages of maturation, similar to the overlapping sequence of vesicles, pustules and crusting seen in chickenpox. The distribution of the lesions is also important, as a number of disorders often present in a characteristic pattern. Generally, if a rash is symmetrical it is more likely to be endogenous than exogenous. In the head and neck area it is important to note if the rash is located around

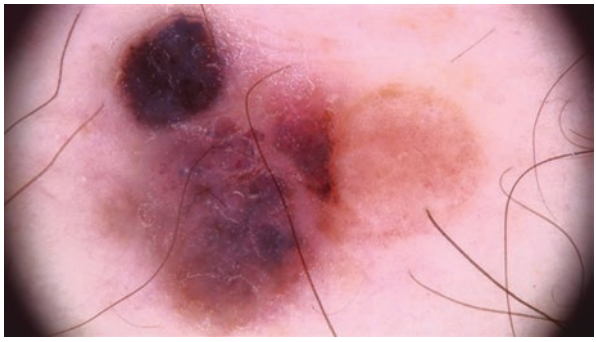

Fig. 39.7 MM dermoscopic appearances

the mouth (perioral), around the eyes (periocular), or if it affects facial convexities or concavities. Some skin complaints can be induced or aggravated by sunlight. In such cases, lesions will typically be absent from the sun-spared skin behind the ears, under the chin and immediately below the columella (Fig. 39.7).

During embryonic development, the cutaneous elements develop and migrate in a particular pattern that is distinct from the other tissues (nervous, vascular, lymphatic and muscular). These patterns are known as Blaschko's lines and are invisible under normal conditions. Cutaneous developmental abnormalities may present at birth or shortly after, appearing along these distributions. They are known collectively as Blaschkitis. Blaschko's lines may also become visible in some skin diseases such as lichen plus or lupus erythematosus. Examples include (1) a "V" shape over the anterior chest, (2) "S" shaped whorls over the chest, stomach and sides, (3) a curvilinear distribution over the limbs and (4) wavy shapes on the head. Although this pattern is rare, if suspected it should be noted.

39.3.2.2 Palpation

This is generally diagnostically less helpful than inspection. However it may enable the differential diagnosis to be narrowed. Whether a lesion is soft, firm or hard may be helpful. Superficial lesions little attachment tend to be mobile, whereas deeper lesions tend to be more tethered. If lesions are warmer than the surrounding normal skin, they may have an increased blood flow suggesting they are vascular, infective or inflammatory in nature. Pulsatile, expansile and compressible lesions should increase suspicion that they are very vascular in nature. Fluctuant lesions are likely to contain fluid. Tender lesions may be infective, or (less likely) malignant in nature. Remembering all these characteristics can be difficult. A useful mnemonic is "S4, C3, T3"—(Size, site, shape, surface, colour, consistency, contour, temperature, tenderness and transillumination).

Scratching or firmly stroking the skin can sometimes result in the localised development of an urticarial reaction. This cutaneous response is known as dermatographism and is thought to result from inappropriate and excessive mast cell degranulation. It can present in the normal population, but is more common in patients with urticaria or angioedema. In other rare and potentially serious conditions the attachments between cells is disrupted, either within the epidermis, or

between the epidermis and dermis. As the skin is weakened, minor friction such as slight rubbing can result in blister formation. This is known as Nikolsky's sign and such patients should be referred urgently for a dermatological opinion. It is also important that, once the sign is elicited not to unnecessarily reproduce it. Depending on the depth of the cellular disruption, subsequent healing can result in scaring.

39.4 Investigating Symptoms and Signs

There are a range of potential investigations that can be helpful in investigating or monitoring skin disease. Depending upon the clinical setting however, only a few may be available urgently.

39.4.1 Laboratory Tests

Biochemistry is not usually helpful in the diagnosis of dermatoses, but it may be useful in other circumstances. With severe, widespread erosive/blistering lesions, patients are at risk of sepsis and fluid loss. Inflammatory markers may be raised in skin infections such as cellulitis or erysipelas. Certain cases of hair loss may also result from an underlying iron deficiency or endocrinopathy which should be excluded by testing. Coeliac serology is a simple blood test which can be helpful if dermatitis herpetiformis is suspected (these conditions are often associated). In suspected lupus, autoantibodies may help confirm the diagnosis. In cases of suspected photosensitivity, porphyria should be excluded by porphyrin testing. Where suspicions of carcinoid syndrome exist, 24 h urine collections for 5-hydroxyindolacetic acid (HIAA) may prove diagnostic. Polymerase chain reaction (PCR) allows for rapid and highly specific diagnosis of some infectious diseases, including those caused by bacteria or viruses.

Bacterial infections are typically painful and have a degree of exudate and/or crusting. Swab any areas of broken skin which are suspicious of bacterial infection with standard bacteriology swabs and send for culture. For recurrent bacterial infections consider swabbing common sites of skin colonisation such as the nose, axillae and groins. Viral infections are typically painful and have grouped, or more rarely, widely disseminated vesicles, pustules or punched out erosions. Swab any punched out erosions or de-roofed pustules or blisters. Consider aspirating any bullae and sending fluid for virology. Swabbing the surface of an intact vesicle or bulla is less likely to yield a diagnosis. Viral swab medium is separate from standard bacterial swabs and usually stored refrigerated. If this is not available send a bacteriology swab in a standard clean universal pot clearly marked for urgent virological examination. With scaly rashes with or without circumferential pustules, consider fungal infection. Scrape the scale off the rash and send for fungal microscopy and culture. Fungal infections can affect the scalp. If clinically suspected, scrapings or plucked hairs can be sent to confirm the diagnosis.

39.4.2 Histology

Occasionally, a biopsy is warranted, although rarely in an emergency department setting. These may be incisional or excisional, depending on the nature, size and location of the lesion(s). When biopsying a rash a better diagnostic yield is obtained by biopsying the active, advancing edge. A biopsy from the established inactive area is likely to only demonstrate pathological changes consistent with the secondary changes. Do not biopsy any lesion suspicious of melanoma—refer urgently to an appropriate specialty. A biopsy in this setting may result in subsequent inaccurate assessment of the maximum depth of the lesion—this could affect staging and subsequent management.

39.4.3 Other Investigations

Patch testing is used to demonstrate delayed (type IV) contact hypersensitivity to specific environmental allergens. Following a focused history, a list of possible allergens is devised. They are then applied to unaffected skin, typically the back, for several days. Interpretation of the results can be difficult—false negatives and positives for many allergens are well recognised. If the patient reacts positively to any allergens that are deemed relevant, the patient is educated about the particular allergen and counselled with avoidance measures.

Wood's lamp is a light source that shines a particular wavelength of ultraviolet light onto the skin. This will stimulate porphyrins to fluoresce pink. It is often used in clinic for the detection of fungal infection of hair, although not all fungal infections of the hair or body demonstrate fluorescence.