JULY 2024 VOL 8 NO 1

A MEDICINE TODAY PUBLICATION

Dermatology Collection

PEER REVIEWED UPDATES FOR MEDICAL PRACTITIONERS

Reprints in Dermatology

Actinic keratosis – an update on management

Evaluation and management of nail diseases

Intertriginous skin disorders: what's lurking where?

Cosmetic laser and light therapies

A woman with rosy cheeks and erythematous facial lesions

DERMATOLOGY COLLECTION
REPRINTS IN DERMATOLOGY
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A MEDICINE TODAY PUBLICATION

Dermatology Collection

PEER REVIEWED UPDATES FOR MEDICAL PRACTITIONERS

FOREWORD FROM THE EDITOR-IN-CHIEF, DERMATOLOGY COLLECTION

Our July 2024 *Dermatology Collection* covers a range of important dermatological presentations, including the management of cosmetic concerns.

Actinic keratoses, also referred to as solar keratoses, appear on sites of chronic ultraviolet radiation exposure and their presence predisposes to the development of all skin cancers. Read about the latest management practices for actinic keratoses, based on guidelines from Cancer Council Australia and the American Academy of Dermatology.

Nail disease and intertriginous skin disorders are common presentations in general practice and the assessment, treatment and management for each are discussed in two articles. Although often benign, both can impair quality of life and be representative of underlying disease. Recognising the common clinical features of different nail diseases, understanding potential treatment outcomes and knowing when to refer if treatment failure occurs are important management cornerstones. Most intertriginous skin disorders can be successfully diagnosed and managed in the primary care setting.

Patients often consult with their GPs about aesthetic concerns, which can be treated using laser and laser-like therapies. Stay up to date on the latest devices used for cosmetic purposes, including intense pulsed light, vascular lasers, pigment lasers and ablative and nonablative lasers.

Finally, test your knowledge with one of our dermatology quizzes. What are the differential diagnoses and an appropriate management approach for a 57-year-old woman who presents with inflammatory facial lesions and background erythema?

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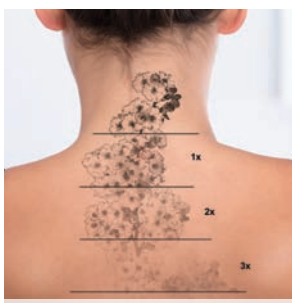

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Actinic keratosis

An update on management

XIN LIN WONG BMed, MD
STEPHEN SHUMACK OAM, MB BS(Hons), FACD

Actinic keratoses (AKs) are potentially premalignant cutaneous lesions that occur on chronically sun-exposed regions of the body. Left untreated, a small proportion of AKs will transform into invasive squamous cell carcinomas. It is important for GPs to be aware of the latest management practices for AKs, based on guidelines from Cancer Council Australia and the American Academy of Dermatology, so as to offer patients evidence-based treatment plans.

KEY POINTS

- The presence of actinic keratoses (AKs) suggests significant ultraviolet (UV) exposure, which predisposes to development of all skin cancers. Patients should be educated about the importance of sun safety, as UV protection is associated with a reduced incidence of AKs.
- Treatment for AKs is broadly classified as lesion-directed therapy, and includes cryotherapy or curettage and cautery, or field treatment, which includes topical and light-directed therapies.
- Cryosurgery is the recommended lesion-directed therapy, whereas 5-fluorouracil and imiquimod are the most effective field treatments.
- Photodynamic therapy involves application of either methyl aminolevulinate or 5-aminolevulinic acid, followed by light activation, either by red light for seven to nine minutes or continuous daylight for two hours.
- Ingenol mebutate is no longer considered a therapeutic option as it is associated with an increased incidence of skin cancers, and has been withdrawn from international markets.
- Tirbanibulin 1% ointment is a novel microtubule inhibitor that requires five days of treatment. It is currently under evaluation for approval by the TGA.

Actinic keratoses (AKs), sometimes referred to as solar keratoses, appear on sites of chronic ultraviolet (UV) radiation exposure. AKs most commonly occur on the face, scalp, dorsal aspect of the upper limbs and legs. They may occasionally produce excess keratin resulting in the formation of a keratotic horn. Lesions classically appear as yellow-white, scaly, rough, hyperkeratotic macules or papules overlying an erythematous base (Figures 1a to c). Generally, these lesions are neither tender nor indurated but have a rough texture. Palpation is thus an indispensable tool to differentiate between normal and sun-damaged skin, AK or squamous cell carcinoma (SCC). As the presence of AKs indicates considerable sun-induced damage, patients will likely have numerous lesions present, which may become confluent over a large field of sun-exposed skin.

Pathogenesis

Cumulative sun exposure causes damage to keratinocytes, which leads to changes in genetic structure. In AK, abnormal keratinocytes are confined within the epidermis; however, have the potential to progress to full-thickness epidermal dysplasia. Once this occurs, there may be progression from AK to keratinocyte carcinoma, which usually requires definitive management.

Currently, no clinically defining features determine whether an AK lesion will progress to SCC and it is therefore difficult to predict and specifically target 'higher- risk AK lesions'. To date, estimates of progressions from AK to SCC vary between 0.1 to 20%.[1] Therefore, it is pertinent to recognise and consider treatment for AKs, as they are all potential precursors of SCC. An area of skin with numerous AKs can indicate a region of field cancerisation. This concept refers to the presence of subclinical

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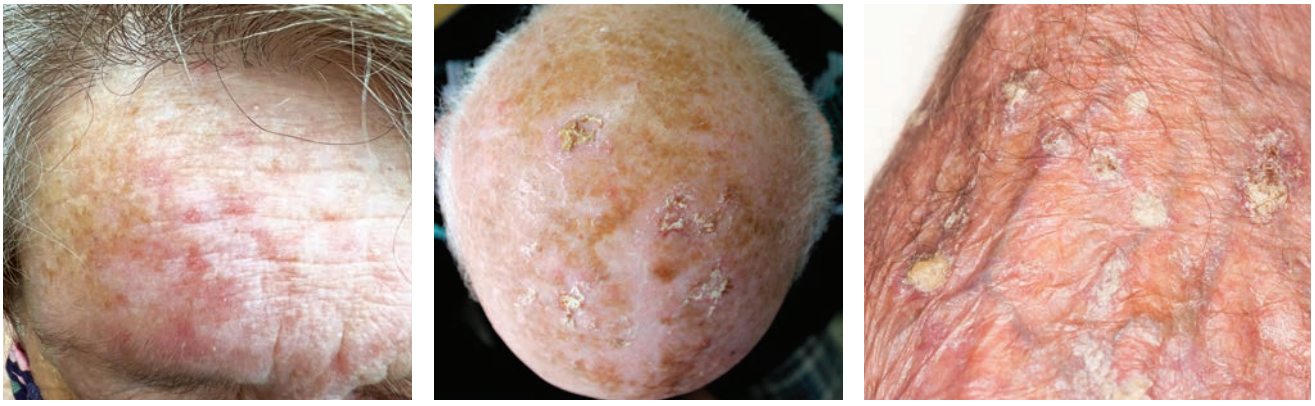


Figures 1a to c. Moderate actinic keratosis (AK) on the forehead (a, left) and yellow-white scaly AK lesions on the scalp (b, middle) and back of the hand (c, right).

precancerous lesions near the vicinity of visible AK lesions that have been affected by the same amount of UV radiation despite a normal outward appearance.[2]

Patients with long-term exposure to UV radiation, fair skin, a history of severe sunburns and those taking photosensitising medications are at a higher risk for developing AKs. Clinicians should be mindful of patients who are immunosuppressed, such as patients receiving organ transplant and those with chronic lymphocytic leukaemia, as the development of AKs and the process of progression may be accelerated.

Role of the GP

Due to its geographical location and high levels of UV radiation exposure, Australia has one of the highest rates of AK development in the world.[3] As highlighted above, recognition and management of AKs are important because of the risk of progression to SCC. The presence of an AK is proof of significant UV light exposure. As a result, patients with AKs are at a higher risk of developing all skin cancers, and management not only involves treating the AK lesions, but also conducting regular skin examinations.

Although diagnosis of AKs is primarily clinical in nature, a biopsy should be considered if there are concerns regarding malignancy. Caution should be exercised when approaching an AK that is bleeding, ulcerated, tender, heavily indurated, nodular in appearance or refractory to treatment, as it may suggest that the AK has already progressed into a keratinocyte carcinoma. Referral to a dermatologist is recommended for patients who are immunosuppressed, have widespread and severe actinic damage and require further management of lesions that are suspected to be keratinocyte carcinomas, or for younger patients with more AKs than expected.

Updates on management

Numerous effective treatments are currently available for AKs (Table). Careful consideration of the lesion (number, distribution, size), patient factors (pain tolerance, compliance to therapy, cosmetic considerations, cost), treatment side effects (tolerability) and rate of recurrence should be taken into account when deciding on the appropriate treatment. Shared decision making on the treatment approach is important as it will increase compliance and the ability to tolerate localised skin reactions. These reactions may cause early termination of treatment before the therapeutic outcome is achieved. Treatment for AKs is largely based on Cancer Council Australia's *Clinical practice guidelines for keratinocyte cancer* (https://wiki.cancer.org.au/australia/Guidelines:Keratinocyte_carcinoma), and is also informed by the American Academy of Dermatology (ADD) *Guidelines of care for the management of actinic keratosis*.[1]

Treatment can be broadly classified as lesion-directed, which targets discrete lesions, or field treatment, which targets a larger area of skin containing multiple AKs. The prevailing consensus favours field treatment as it has the potential to concurrently treat subclinical lesions. Studies have shown that general UV protection and sunscreen is associated with a reduction in the development of new AKs and, therefore, all patients should be educated, with emphasis on the importance of ongoing sun protection, as part of their management plan.[4,5]

Lesion-directed treatment

Cryosurgery

Liquid nitrogen cryotherapy is a commonly performed procedure for the treatment of AKs. Dermatologists strongly recommend the use of cryotherapy for discrete AKs as it is fast, readily available and efficacious.[1] The duration of the freeze time tends to parallel response rates, and general consensus suggests three to five seconds as part of a single or double freeze-thaw cycle.[6] Patients should be warned that the lesion will swell due to oedema and may blister, and of the risk of hypopigmentation, especially patients with darker skin types.[7] Clinicians may prefer this approach as it is low cost and does not require patient compliance or local anaesthetic. It should be noted that cryotherapy does not

FIGURE 1B © DERMATOLOGY11/SHUTTERSTOCK.COM
FIGURE 1C © DR P. MARAZZI/SPL

TABLE. TREATMENTS FOR ACTINIC KERATOSES

Medication	Recommended regimen	Mechanism of action	Comments
Lesion-directed treatments			
Cryotherapy	• Three to five second freeze as part of a single or double freeze-thaw cycle	Freezes and destroys cells through direct trauma	• Fast and readily available • Duration of freeze correlates with rate of clearance • Exercise care with cryotherapy on lower legs due to poor healing • Does not differentiate between AK and normal skin tissue
Curettage and cautery or electrodessication	• Shave biopsy followed by scraping with a curette and cauterisation/electrodessication	Surgical removal of lesion	• Requires local anaesthetic and will leave a scar • Useful if lesions require biopsy • Lesion can be addressed in a single visit
Field treatments			
5-fluorouracil 5% or 4% cream or solution (with 10% salicylic acid)	• Cream is applied once or twice daily for two to four weeks • 0.5% solution is applied daily for up to 12 weeks	Inhibits thymidylate synthase and 5-flurouracil incorporation into RNA and DNA	• One of the most commonly adopted field therapies • Contraindicated in pregnant women or patients with dihydropyridine dehydrogenase enzyme deficiency
Imiquimod cream	• Applied three nights a week for three-to-four-week cycles or continually for up to 16 weeks	Toll-like receptor 7 agonist	• Treatment cycle can be repeated if required • Inflammatory reactions vary in severity between patients
Photodynamic therapy (PDT)	• A photosensitising agent is applied, and occluded for three hours if using red light illumination in the clinic, before exposure to daylight	Photodynamic reaction between photosensitiser and light leads to production of cytotoxic free oxygen radicals	• Red-light PDT requires specialised equipment and restricted to use in specialist centres
Diclofenac gel	• Applied twice daily for 60 to 90 days	Blocks cyclo-oxygenase activity and inhibits ultraviolet-induced proinflammatory cytokines	• Caution in patients with gastrointestinal bleeding or ulcers • Should not be used with concurrent oral NSAID use

Adapted from: Dermatology Expert Group. Solar damage and skin cancer. In: eTG complete (Internet). Melbourne: Therapeutic Guidelines Limited, 2022; and Guidelines of care for the management of actinic keratosis. J Am Acad Dermatol 2021; 85: e209-e33.[1]

preferentially destroy diseased skin, and resolution rates are reported to range between 57 and 98.8%.[8-12]

Curettage and cautery/ electrodessication

For lesions that are above average thickness or suspicious, curettage and cautery or electrodessication may be a useful modality as the initial shave biopsy can provide a specimen for histological assessment if diagnosis is uncertain. The area should then be scraped with a curette and cauterised to ensure the lesion is adequately treated. Patients should be warned that this technique will likely leave a scar and of the risk of wound infection and hypopigmentation.[7] It is essential to note that only operators who have received appropriate training should conduct this therapy.

Field treatment

Treatment of field cancerisation is especially advantageous in patients with high density AKs or lesions without distinct borders for which localised therapy is undesirable. This management approach is favourable as seemingly healthy skin in the vicinity of AK lesions is theoretically affected by the same amount of UV radiation-induced damage and may contain precancerous keratinocytes, despite a normal outward appearance. Field therapy is usually topical in nature and relies heavily on patient compliance to achieve desirable therapeutic outcomes. Inflammatory reactions, such as erythema, soreness, erosions and crusting, are to be expected and are necessary to treat the atypical keratinocytes present (Figure 2). Patients should be educated about the importance of these reactions and their expectations managed to avoid poor adherence and subsequent poor outcomes. A range of therapies with varying treatment durations are currently available; however,

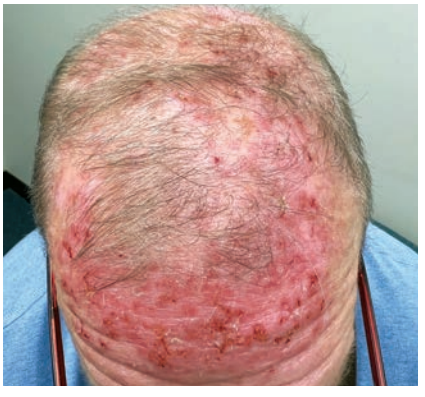
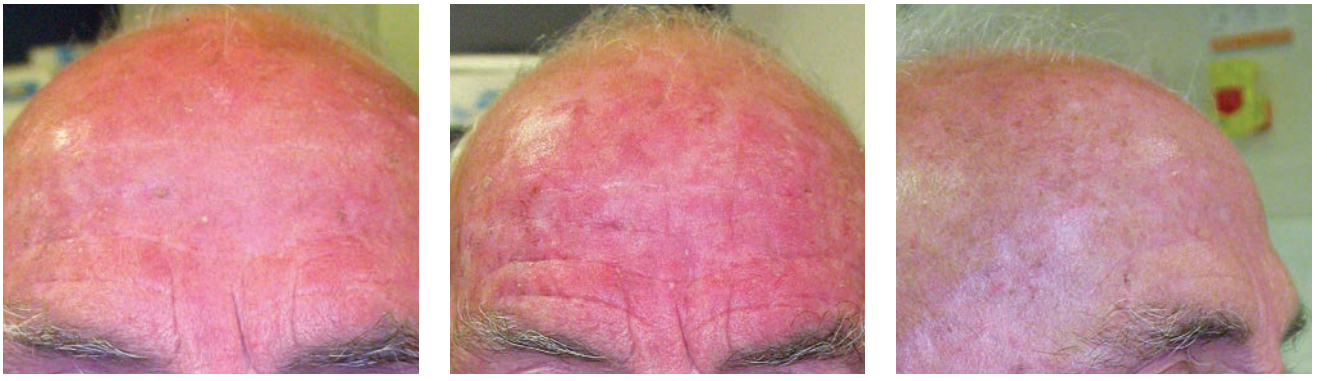


Figure 2. Expected reaction two weeks after treatment with 4% 5-flourouracil.



Figures 3a to c. A patient with multiple actinic keratoses on the scalp and forehead treated with 5% 5-fluorouracil. a (left) Before treatment; b (middle) at four weeks' treatment; c (right) six months after treatment.

Images courtesy of Associate Professor Alvin Chong.

those with the shortest treatment duration may be preferred by some patients.

5-fluorouracil

5-fluorouracil (5-FU) is a topical cytotoxic agent and is available in Australia as 5% and 4% creams and a 0.5% solution (also containing 10% salicylic acid). It inhibits both DNA and RNA synthesis in rapidly dividing cells, leading to apoptosis. There is preferential uptake in rapidly dividing cells and, therefore, it is selective for atypical cells. The AAD strongly recommends the use of 5-FU for field treatment of AKs, based on current available evidence.[1] Some clinicians may even use 5-FU to identify subclinical AKs before staring cryotherapy.[13] It is recommended that a thin layer of 5-FU cream is applied once or twice daily for two to four weeks, or for as long as a patient can tolerate (Figures 3a to c). A combination of 0.5% 5-FU and 10% salicylic acid solution is available; it is indicated for lesion and/or small field (<25 cm^2) therapy, and is used once daily for up to 12 weeks.[14] We advise this as a regular (every few years) winter time activity for high risk individuals and patients should be warned that localised irritation is to be expected.

Imiquimod

Imiquimod is an immune response modifier that activates toll-like receptor 7. The AAD strongly recommends the use of various concentrations of imiquimod for the field treatment of AKs.[1] Imiquimod 5% cream is approved by the TGA for the treatment of AKs, specifically on the face and scalp. Application regimens can be three times a week in four-week cycles or consecutively for up to 16 weeks, in accordance with patient preference.

Photodynamic therapy

Photodynamic therapy (PDT) uses the application of a topical photosensitiser, either methyl aminolevulinate (MAL) or 5-aminolevulinic acid (5-ALA) and light activation to cause a photodynamic reaction, leading to the production of cytotoxic oxygen free radicals. A 1 mm layer of cream is applied onto the area under an occlusive dressing for three hours. The area is then wiped clean and illuminated by red light for seven to nine minutes in the clinician's office.[15] Alternatively, after application of MAL or 5-ALA, patients can immediately expose the treated area to daylight for two continuous hours.

A single treatment is recommended, with results assessed at three months and a second treatment needed only if residual lesions remain.[15] The former method is sometimes favoured by clinicians, as it does not rely on patient compliance. Daylight PDT is less painful and can be performed all year round. It has been found to be equally as effective but less painful than red-light PDT when 5-ALA is used.[1] Red-light PDT may require the use of anaesthetic and is only available at practices with the appropriate equipment and trained staff.

Diclofenac

Diclofenac sodium gel 3% is thought to induce cell death and inhibit cell proliferation in AKs. Currently, the AAD conditionally recommends the use of diclofenac based on lower quality evidence.[1] It should be applied twice daily for 60 to 90 days to achieve effect. Diclofenac should be used with caution in patients with a history of gastrointestinal bleeding or ulceration. It should not be used in patients who are concurrently receiving oral NSAIDs for other health conditions.

Chemoprophylaxis for immunosuppressed patients

Patients who are immunosuppressed, especially those who have received solid organ transplants, have a higher risk of developing keratinocyte cancer. It is therefore important for these patients to use adequate sun protection and undergo regular skin checks. Systemic chemoprevention with low-dose acitretin has been found to be efficacious in this group of patients.[16] Although it was previously thought that nicotinamide could be used as a form of chemoprophylaxis, the current evidence is inconclusive.[17]

Tirbanibulin

Tirbanibulin 1% ointment is a novel microtubule inhibitor that induces expression of p53 and causes apoptosis in rapidly dividing cells.[1,18] Phase 3 clinical trials have shown a complete clearance rate ranging from 44 to 54%. The treatment regimen is short, consisting of daily application for five days and is therefore preferred by some patients. Among treated patients, rates of recurrence at one year were higher at 47% compared with 5-FU- or imiquimod- treated patients.[18] Most trial patients were Caucasian with Fitzpatrick skin types I and II, which should be considered when interpreting the results.[18] Further research is needed on the long-term side effects. Tirbanibulin is currently contraindicated in pregnancy and women who are breastfeeding due to lack of data. Tirbanibulin has been approved by the US Food and Drug Administration and is awaiting release in Australia. It is recommended for use on the face or scalp on an area up to 25 cm^2.[19]

Discontinuation of ingenol mebutate

Ingenol mebutate gel was first introduced in 2012 as an efficacious, short duration treatment for AKs. Its mechanism of action is believed to have been neutrophil- mediated immunostimulatory effects, leading to apoptosis of dysplastic cells. Its use has since been found to increase the incidence of non-melanocytic skin cancer in areas of treated skin and has been withdrawn from the market and will be permanently discontinued worldwide. Thus, ingenol mebutate is not recommended for the treatment of AKs.[1]

Conclusion

AKs are caused by chronic UV radiation damage and are precursors to keratinocyte cancer. Treatment can be lesion directed or field directed. Currently, there is strong evidence to recommend cryotherapy for lesion-directed therapy and topical 5-FU and imiquimod for field treatment. Novel medications, such as tirbanibulin, are being developed but should be used with caution until data from long-term trials are available. MT

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Evaluation and management of nail diseases

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Nail disease is a common presentation in general practice. Recognising the clinical features of the various nail diseases can ensure that patient referrals to a dermatologist are prompt and that diagnosis and treatment are not delayed.

KEY POINTS

- Nail disease is a common presentation in general practice and can often be representative of systemic disease.
- The most frequent conditions presenting to general practice include onychomycosis, psoriasis, trauma and melanonychia.
- Recognition of the common clinical features of nail disease, particularly those representing malignancy, can ensure that patients are appropriately referred to a dermatology service and that diagnosis and treatment are not delayed.
- Nail disease can be difficult to treat given the anatomy and associated poor penetrance of treatments, and results may take time to occur; thus, having realistic expectations of treatment outcomes and knowing when to refer in treatment failure is important.
- Patients with longitudinal melanonychia and other features demonstrating dystrophy in the absence of trauma should be promptly referred to a dermatology service.

Nail presentations in general practice are often benign but can provide important clues to the diagnosis of systemic or localised disease. Nails protect the ends of each digit and contribute to dexterity; as such, nail disease can cause pain and lead to functional impairment, as well as aesthetic concerns. Recognising and assessing these changes and features ensures timely diagnosis to facilitate appropriate management. Management is largely facilitated within the primary care setting, but several conditions warrant further specialist input.

The treatment of nail disease can often be challenging owing to the anatomy of the nail, the refractory and indolent nature of many nail conditions and often, the limited scope of treatment options within general practice. The most common nail diseases seen within primary care include fungal infections, psoriasis, trauma and melanonychia. This article summarises common nail presentations and provides an overview of their assessment and treatment.

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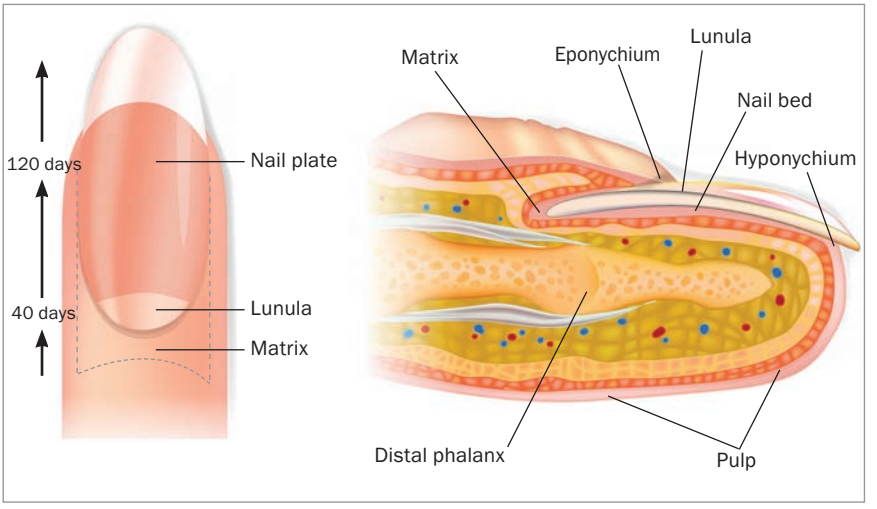


Figure 1. Anatomy of the nail unit.

Nail anatomy

Understanding the anatomy of the nail provides insight to the origins of nail disease, as well as the foundations for targeted treatment approaches (Figure 1). The nail matrix is the underlying tissue from which the nail is formed; it is covered by the proximal nail fold and lies close to the bone of the terminal phalanx. The bone is important in forming the shape of the nail. The cuticle (eponychium) arises from the proximal nail fold and is important in protecting the nail matrix by forming a waterproof seal. The nail plate consists of keratin filaments and lies in close apposition to the nail bed. It has longitudinal grooves that interdigitate with the corresponding grooves in the nail bed, allowing for firm adhesion; the area of strongest adhesion is the distal margin of the nail bed, with a corresponding deeper pink hue.[1]

Assessment

The assessment of nail disease requires a thorough history and examination. The personal or family history of cutaneous malignancy, history of preceding trauma or procedures (podiatry, manicuring), presence of systemic disease (e.g. psoriasis, lichen planus), nutritional status, medications being taken, ethnicity, occupation and hand dominance are all part of history taking.

Nails can be affected by infection, trauma, inflammatory disease and malignancy. The common clinical features to identify and assess and the differential diagnoses to consider during an examination of a diseased nail are summarised in Table 1.

Investigations

Most nail diseases can be diagnosed with thorough examination, often in conjunction with dermoscopy. In some cases, further assessment may be required through biopsy. Nail samples, including clippings or scrapings, can be collected in general practice and sent for microscopy and culture, histology or polymerase chain reaction (PCR) testing.

Occasionally, other imaging modalities may be required for further characterisation. Ultrasounds are useful for detecting cystic lesions (e.g. pseudomyxoid), whereas magnetic resonance imaging is useful for detecting glomus tumours. Plain film radiography and broader investigations may form part of the work up to investigate other systemic underlying diseases. Confocal laser scanning microscopy is an innovative, non invasive imaging technique allowing for the examination of nail specimens, thereby avoiding the need for biopsy.[2]

Referral

Patients with refractory conditions, particularly in conjunction with other cutaneous disease or where malignancy needs to be ruled out, should be referred to a specialist dermatology or nail service. Malignant melanoma forms an important differential for any presentation of melanonychia or nail dystrophy in the absence of trauma (amelanotic melanoma).

Common nail diseases

Patients may present with one or more of the many common nail diseases.

Onychomycosis

Onychomycosis, or fungal infection, is the most common nail disease (Figures 2a and 2b). It is a treatable cause of nail thickening, and the toenails are more often involved than the fingernails. The risk factors include immunosuppression, advancing age and the presence of diabetes. Fungal infections are mostly caused by dermatophyte infections, with 80% of cases caused by *Trichophyton rubrum* or *Trichophyton mentagrophytes* var. interdigitale, as well as other nondermatophyte causes include yeasts (*Candida*) and moulds (including *Aspergillus*).[3] Patients should be assessed for intercurrent tinea pedis. Although onychomycosis is often a cosmetic problem, it can lead to pain or cellulitis if left untreated. Clinical classification is based on the site of fungal invasion (Table 2).

Diagnosis

When a fungal infection is suspected, several samples of nail clippings, nail scrapings and subungual debris should be sent for microscopy and culture, ensuring the nail is adequately cleaned beforehand to prevent contamination. Direct light microscopy using a potassium hydroxide solution can detect hyphae, which confirms fungal infection. However, a culture is required to identify the fungus, the results of which often take four to six weeks to obtain. Histological evaluation can also detect fungal infection with periodic acid-Schiff staining.

Treatment

Eradication of a fungal infection and complete treatment are often difficult to achieve as there is a tendency for recurrence.[4] Cures can be defined as mycotic, indicating the absence of the disease-causing organism on microscopy and culture, or clinical, indicating improvement in the appearance of the nail. It can take up to a year to achieve a completely normal appearance of the nail and, therefore, giving patients realistic expectations of the trajectory and outcome is important.

The treatment of choice is terbinafine (250 mg daily for three months), with 70 to 80% of patients showing complete improvement, and a 10% recurrence rate affecting toenails. For fingernails, a six-week course is sufficient. The side effects include gastrointestinal complications, and monitoring with liver function tests is advised.[5,6]

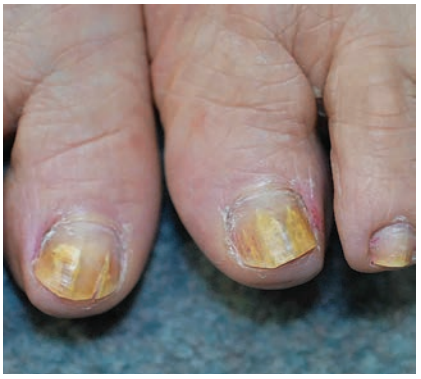
Alternatively, itraconazole administered in pulse doses can help achieve a cure rate of 70%, with an 11% recurrence rate. The dose is 200 mg twice a day for one week each month, and the number of pulses may differ between fingernails and toenails. This dose regimen is often better tolerated by patients than the terbinafine treatment regimen, promoting greater compliance. Itraconazole has a broader spectrum of activity, including against *Candida* and mould, compared to that of terbinafine, with a similar side effect profile.[5,6]

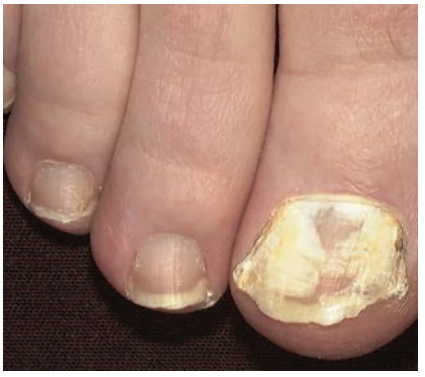
Topical therapies such as nail lacquers (e.g. amorolfine) and over-the-counter mentholated ointments have varying success. These are more effective for superficial white onychomycosis. In general, it is more difficult for these treatments to penetrate through the nail plate. New triazole-based antifungal agents, including posaconazole and ravuconazole, warrant further exploration as treatment options.

Referral to a dermatology service is required for treatment-resistant cases. In treatment-refractory cases, some patients may require whole or partial nail removal. Physical therapies, such as photodynamic therapy with the use of aminolevulinic acid and excimer pulsed dye lasers, may be

TABLE 1. COMMON PRESENTING FEATURES OF NAIL DISEASE

Clinical features	Assessment and differential diagnoses
Nail dystrophy or destruction	• Most commonly related to trauma, an underlying mass or haematoma; it is a feature of Bowen's disease • Any evidence of nail dystrophy, in the absence of trauma, should prompt suspicion of possible malignancy with subsequent specialist referral
Melanonychia	• Pay close attention to the history relating to onset, distribution and subsequent changes in colour: – chronic discolouration that has remained stable for a period is less concerning for malignancy – melanonychia present in multiple nails may be related to benign melanocytic activation seen in Asian and dark-skinned populations – longitudinal melanonychia with variations in colour and band width is an important feature; thick bands of varying widths expanding greater than 6 mm are more suspicious for melanoma • Dark blue to black discolouration with associated onycholysis and a history of preceding trauma is likely to represent subungual haematoma • Discolouration can also be because of certain drugs, including minocyclines and dyes
Other forms of discolouration of the nail plate	• White (leuconychia): liver cirrhosis, hypoalbuminaemia, striate leuconychia, superficial onychomycosis • Yellow: fungal effects, drug-related effects, high levels of bilirubin • Green: aspergillosis, *Pseudomonas* infection, bruising • Red: tumour, cardiac failure • Blue: drug-related effects (e.g. antimalarial agents), cyanosis (i.e. vasoconstriction and diminished peripheral blood flow)
Nail thickening (subungual hyperkeratosis)	• Can be developmental or can be related to trauma, psoriasis or tinea
Nail thinning	• Lichen planus, trauma, brittle nails, twenty-nail dystrophy
Onycholysis	• Occurs when there is a functional separation of the nail plate from the nail bed; characterised by an obvious distal white area as it detaches from the free edge of the nail • Associated with multiple conditions including trauma, nail cosmetic use, psoriasis, systemic disease, photosensitivity or underlying masses and malignancies
Pitting	• Results from the loss of parakeratotic cells from the surface of the nail plate; usually seen as a feature of psoriasis
Pain	• Not often the most common presenting complaint but may be a feature of paronychia, ingrown nails, trauma or tumours
Abnormal curvature	• Koilonychia (spoon-shaped nails) – iron deficiency and other nutritional store abnormalities – hereditary or idiopathic – can be a normal variant in newborns and may spontaneously regress in childhood • Clubbing (increased nail plate curvature with soft tissue hypertrophy of the digital pulp; often closely related to systemic disease) – chronic liver disease, lung carcinoma, chronic obstructive pulmonary disorders
Nail grooves	• Longitudinal: myxoid cyst, angiofibroma, median nail dystrophy, ageing • Horizontal: Beau's lines – a sign of severe systemic illness disrupting nail growth and causing damage to the cuticles





Figures 2a and b. a (left). Distal and lateral subungual onychomycosis. b (right). Superficial white onychomycosis.

effective against onychomycosis. The laser penetrates and heats the nail to destroy the disease-causing organism. However, these treatments are painful and expensive.[7]

Nail psoriasis

Nail psoriasis can present like onychomycosis; the clinical features are often non-specific and may be common with those of other conditions. Psoriasis affecting the nail bed may include onycholysis, subungual keratosis, oil spot discolouration and splinter haemorrhages (Figure 3). Nail matrix disease may present as pitting, a crumbling nail plate, red spots in the lunula or leuconychia.

Nail psoriasis is present in about half of patients with psoriasis and may be associated with greater severity in terms of the extent of body surface involvement and treatment resistance.[8,9] The incidence of nail disease in patients with psoriatic arthritis is greater than 80%. It is important to assess the quality of life in patients with nail psoriasis, given both the functional and emotional impacts of the disease.[8]

TABLE 2. CLINICAL CLASSIFICATION OF ONYCHOMYCOSIS

Classification	Features
Distal and lateral subungual onychomycosis (Figure 2a)	• Most common variant, and in most cases, related to dermatophyte infection including *Trichophyton rubrum* and *Trichophyton mentagrophytes* var. interdigitale • Affects the hyponychium at either the distal or lateral edges and spreads proximally along the nail bed, resulting in subungual hyperkeratosis and onycholysis • Clinically presents in a similar way to other forms of nail thickening, but a differentiating factor can be the presence of white or yellow streaks • Nail plate may become friable and start to break up in advanced cases • Examination of the surrounding skin will likely reveal intercurrent tinea pedis
Superficial white onychomycosis (Figure 2b)	• Less common variant, affecting the surface of the nail plate • Generally confined to the toenails and caused by *T. mentagrophytes* var. interdigitale • Clinically presents with white superficial plaques; onycholysis not often present
Proximal subungual onychomycosis	• Uncommon variant, usually affecting those with intercurrent disease or immunosuppressed patients, particularly those with human immunodeficiency virus infection
Total dystrophic onychomycosis	• Most advanced form with involvement of the entire nail • Clinically appears thick and opaque with a yellow-brown colour • Causative organisms are *T. rubrum* and *T. mentagrophytes* var. interdigitale

Assessment

The assessment of nail psoriasis includes ruling out onychomycosis by microscopy and culture of nail clippings. Histopathological features suggestive of psoriasis include parakeratosis. The Nail Psoriasis Severity Index is a simple assessment tool to evaluate nail psoriasis.[10] To obtain a score on this index, each nail is divided into four quadrants and a score is ascribed depending on the presence of specific features in each quadrant.

Management

The management of nail psoriasis involves avoiding trauma; this includes manicuring and nail biting. As with cutaneous psoriasis, nail psoriasis exhibits the Koebner phenomenon (the appearance of new skin lesions in previously unaffected areas), by which trauma exacerbates the disease.

Topical treatment includes topical corticosteroids or calcipotriol in ointments, creams, lotions or nail lacquers that can be used for disease affecting the nail matrix or nail bed; however, treatment success is poorly documented.[11] The side effects of topical corticosteroids may include telangiectasia or atrophy of the surrounding skin.

Intralesional corticosteroid injections into the nail matrix or nail bed are effective, albeit a painful option.[12] Dexamethasone iontophoresis has minimal side effects and may be beneficial for patients who are resistant to topical treatments.[13] The therapy duration is 20 minutes weekly, for four to six months (Figures 4a and 4b).

Systemic treatments include methotrexate, ciclosporin, acitretin and apremilast. These are generally used for patients with concurrent systemic psoriasis. Systemic biologic therapies for the treatment of

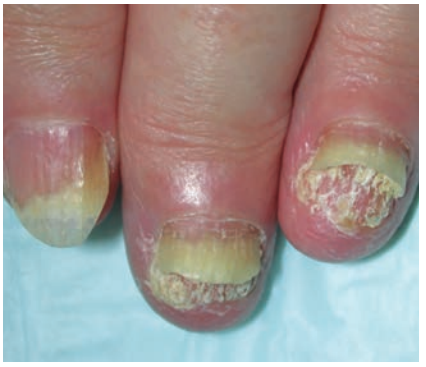
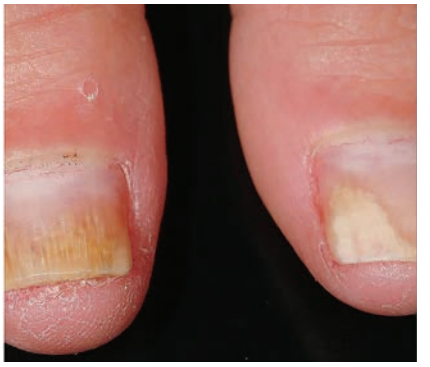
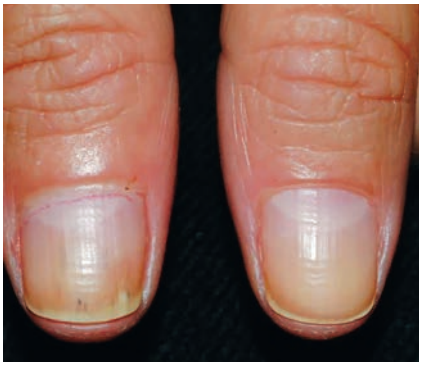


Figure 3. Nail psoriasis with subungual hyperkeratosis, onycholysis, pitting and dystrophy.





Figures 4a and b. Nail psoriasis before (a, left) and after (b, right) treatment with dexamethasone iontophoresis.

cutaneous psoriasis have additionally demonstrated efficacy in patients with nail psoriasis; as such, future treatment may centre on these emerging therapies.[14] However, these are not currently PBS subsidised for nail disease alone so they are not accessible for patients in the absence of systemic disease.

Longitudinal melanonychia

The presentation of longitudinal melanonychia on the nail plate represents a spectrum of benign conditions including melanocytic nevus or racial melanonychia. Despite this, it is often difficult to distinguish features clinically from nail unit melanoma, which carries a disproportionally high mortality rate when compared with other forms of cutaneous melanoma.[15]

Nail unit melanoma is a malignant melanoma of the acral lentiginous type and can involve any part of the nail matrix. It is rare, accounting for 1 to 2% of all cutaneous presentations, with a higher incidence in Asian populations. Some patients report a history of preceding trauma.

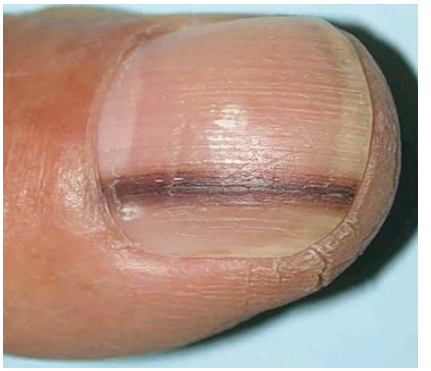
Longitudinal melanonychia is characterised by dark brown or black longitudinal streaks within the nail plate (Figures 5a and 5b). The disease presents when melanocytes within the nail matrix are either activated or proliferate (benign or malignant). The most common locations are on the thumb or great toe, presenting on an isolated digit.

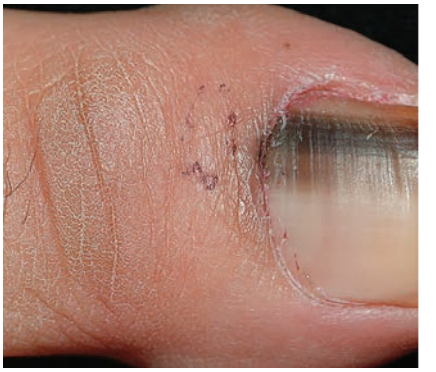
The associated high-risk clinical features that should raise suspicion for nail unit melanoma are summarised in the Box. No single feature is pathognomonic. Any case of nail destruction or dystrophy, in the absence of trauma, should warrant suspicion and prompt referral to a dermatology or nail service. Hutchinson's sign, both a clinical and dermoscopic feature, is an extension of the darker pigment originating in the nail matrix onto the adjacent cuticle and proximal or lateral nailfolds. It is an important clue for melanoma; however, this is not present in all cases of malignancy (Figure 6).[16] Treatment and prognosis are guided by the thickness and level of invasion of melanoma. Malignant melanoma will often require wide local excision and amputation of the distal phalanx, and patients may be referred to a multidisciplinary team to co-ordinate adjunctive therapies.

Bowen's disease (squamous cell carcinoma in situ)

Bowen's disease, an intraepithelial carcinoma, is one of the most frequently occurring nail malignancies, often presenting as verrucous lesions with associated nail plate dystrophy involving multiple fingernails (Figure 7). It often follows a slow, asymptomatic clinical course before becoming invasive. As such, misdiagnosis, or a delay to diagnosis, is common. It is associated with human papillomavirus (HPV; subtypes 16 and 32) and genital warts.[17]

Diagnosis is based on the results of punch or longitudinal biopsy. PCR assays are used to detect HPV DNA. The treatment includes photodynamic therapy or





Figures 5a and b. Longitudinal melanonychia. (a, left). Narrow band with blurred lateral edges. (b, left). Wide bands with variegated pigment.

HIGH-RISK CLINICAL FEATURES OF NAIL UNIT MELANOMA

- Band width greater than 6 mm
- Proximal widening
- Variegated pigmentation with a history of change in colour
- Hutchinson's sign (proximal pigmentation) (Figure 8)
- Associated nail dystrophy, ulceration, bleeding and nodules
- Extension of pigment to the free edge of the nail or periungual spread and distal pigmentation
- Blurring of borders

imiquimod, although the latter has poor results.[18] Mohs surgery is often the most successful approach, allowing for complete eradication of the tumour while preserving normal tissue and function.[19] Patients presenting with dystrophy or warty lesions should be referred to a dermatology service to rule out Bowen's disease.

Myxoid pseudocysts

Myxoid pseudocysts occur as firm cysts that are red or translucent in the proximal nail folds of the fingers, and longitudinal grooving of the nails may occur as a result. They do not contain an epithelial lining, differentiating them from true cysts (Figure 8). These cysts have tracts that connect back to the joint from the fingernail or toenail; arthritis at the end of the finger may predispose development. Recurrence is common.

Management involves physical therapies (e.g. cryotherapy, electrocautery, sclerosant injections, intralesional corticosteroid injections or excision of the cyst) or surgery (involving incision and drainage or cyst removal).

Figure 6. Hutchinson's sign involving pigmentation of the proximal nail fold.

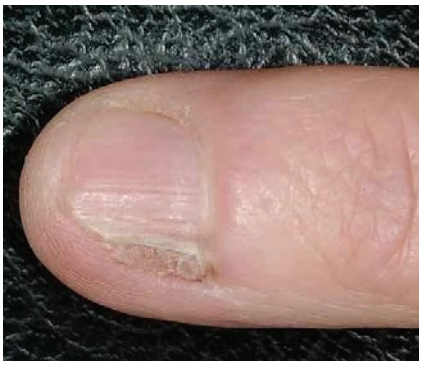


Figure 7. Bowen's disease with nail dystrophy.

Onychopapilloma

Onychopapilloma is a benign neoplasm of the nail bed and nail matrix. The most common associated clinical features are red or white longitudinal streaks (erythronychia and leuconychia) and a subungual keratotic mass (Figure 9a). Melanonychia, splinter haemorrhage, distal fissuring and onycholysis have all been described (Figure 9b).[20] It is usually painless but may impact dexterity.

Onychopapilloma can be diagnosed through the assessment of a nail clipping; samples should include the entire distal nail plate, not just the affected portion. Definitive diagnosis requires excision of the tumour, which is the mainstay of treatment.

Malalignment

Malalignment refers to deviation of the long axis of the nail from the axis of the terminal phalanx with clinical features (Figure 10). It can be congenital, post-traumatic (laceration to the nail matrix or fractures of the terminal phalanx) or iatrogenic (wide lateral nail biopsies), and usually affects the great toenails. About half of congenital cases will spontaneously resolve by the age of 10 years.

Late-onset malalignment without an inciting precipitant is often the result of unnoticed mild or minimal deviation in childhood, and then repeated chronic low-grade trauma, including exercise or tight footwear against the toenail.[21]

Treatment includes ensuring footwear fits appropriately and maintaining a shorter nail length. Toe taping works to counter the lateral pull exerted by the extensor tendons of the hallux and ameliorate distal nail wall hypertrophy. Podiatrists can assist

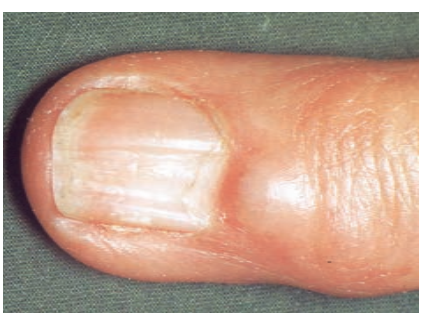
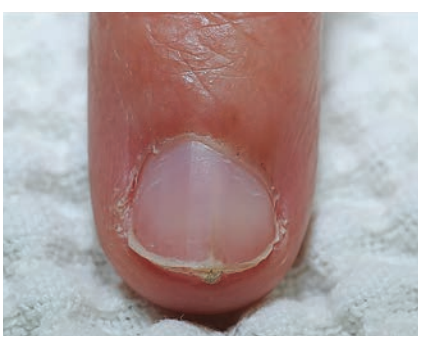
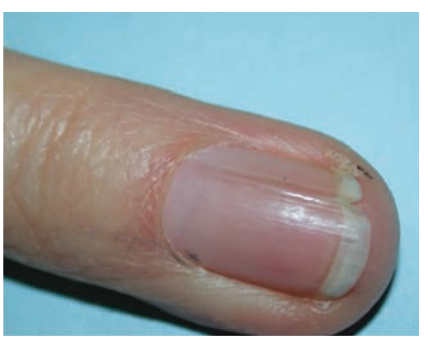


Figure 8. Myxoid pseudocyst at the proximal nail fold with associated longitudinal grooving of the nail plate.





Figures 9a and b. Onychopapilloma with a subungual keratotic mass under the nail plate (a, left) and fissuring of the distal edge (b, right).

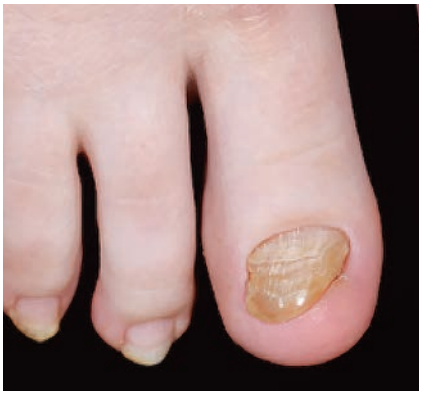


Figure 10. Lateral deviation of the long axis of the nail plate with associated grey/brown discolouration and transverse ridging (oyster-shell deformation).

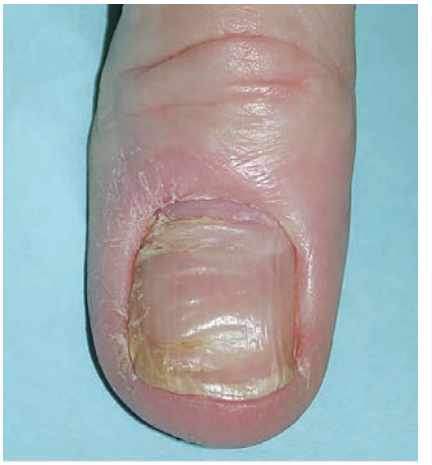


Figure 11. Chronic paronychia.

with burring the thickened nail. Cases of severe or persisting malalignment may need surgery involving rotation of the whole nail unit (nail matrixectomy).

Chronic paronychia

Chronic paronychia is most prevalent in people with frequent exposure to water, soap and detergents. Damage to the cuticle occurs, leading to erythema of the proximal nail fold and swelling (Figure 11). The damaged cuticle is more susceptible to water and chemical penetration to the nail matrix and inflammation on the surface of the nail fold. It is also associated with dermatitis and infection with *Candida albicans* or *Pseudomonas*.

Management is environmental, with the avoidance of contact with aggravating agents, wearing of gloves, avoidance of trauma around the cuticles and application of barrier creams such as petroleum jelly to the nail fold. Cuticle regeneration usually takes six weeks.

Conclusion

Patients often present with nail disease in general practice, and these presentations can be acute or chronic. The most common presentations include onychomycosis, psoriasis, trauma and melanonychia. Recognising the key clinical features and management options can prevent treatment delays. Most nail diseases can be investigated and treatment initiated within the general practice setting; however, treatment may require persistence, and failure is common. Referring these patients, as well as red-flag presentations, promptly to a dermatologist or dedicated nail service can expedite and improve the management outcomes for these patients. MT

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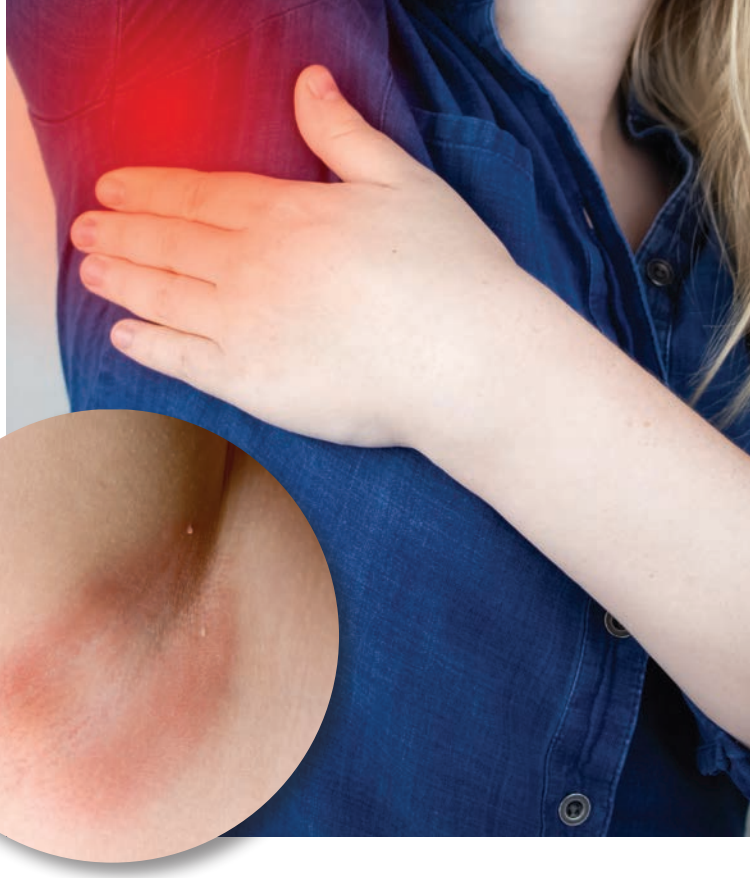
COMPETING INTERESTS: None.

Intertriginous skin disorders

What's lurking where?



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Although intertriginous skin disorders are generally benign, some can impair quality of life or be life threatening. A careful history and clinical examination can diagnose the majority of these disorders; however, in flexural locations, friction and maceration can alter their characteristic appearance. Most intertriginous skin disorders can be successfully managed in the primary care setting, with certain cases referred for specialist opinion.

Intertriginous skin disorders are common presentations in general practice. They encompass a wide variety of infectious, inflammatory, genetic and neoplastic processes, which range from benign self-limiting conditions to chronic diseases that can impair quality of life or be life threatening.[1] Flexural skin is intrinsically prone to friction, which can lead to superimposed infections, highly variable clinical features and diagnostic difficulties. With a structured approach, most cases can be successfully diagnosed and managed in primary care, while certain cases should be referred for specialist opinion. This article discusses the diagnosis and management of skin disorders that occur in intertriginous areas, with or without skin involvement elsewhere.

What constitutes intertriginous skin?

Intertriginous areas are sites in which opposing skin surfaces come into contact and result in chronic skin occlusion. The main intertriginous skin areas are the groin folds, axillae and natal cleft. Body habitus may create additional intertriginous sites, such as inframammary and abdominal skin folds.

Diagnosis

Most intertriginous skin disorders can be diagnosed primarily on the basis of a careful history and examination, with the list

KEY POINTS

- Most intertriginous skin disorders can be successfully diagnosed and managed in the primary care setting.
- The majority of intertriginous skin disorders can be diagnosed primarily on the basis of a careful history and examination. Lesion morphology is a very important diagnostic aid.
- Examination of non-intertriginous sites (including the nails) may reveal useful diagnostic features.
- Failed response to adequate treatment should prompt reconsideration of the diagnosis.
- Dermatologist referral is indicated for a patient with the suspected first presentation of a genetic disorder, an urgent condition, severe or treatment-recalcitrant disease, or uncertain diagnosis. Emergency department referral is required for a patient who is systemically unwell.

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1. MOST COMMON INTERTRIGINOUS SKIN DISORDERS IN ADULTS: KEY FEATURES

Cutaneous candidiasis
- Erythematous macerated plaque with peripheral scale and satellite pustules
- Commonly affected sites include submammary and abdominal folds

Erythrasma
- Well-circumscribed pink or brown patches with fine scale and superficial fissures
- Most common flexural sites are the intergluteal folds and submammary areas but it can also occur in the axillae, groin and umbilicus
- Rash exhibits characteristic coral-red fluorescence under Wood's lamp

Granular parakeratosis
- Brownish red, scaly patches with various degrees of maceration secondary to local occlusion and, in later stages, desquamation
- Most commonly affects the axillae but can occur in other intertriginous areas

Inverse psoriasis
- Well-circumscribed pink to erythematous plaques with little or no overlying scale
- Typically occurs in the armpit, groin and natal cleft, as well as in the umbilicus and external auditory canal

Irritant contact dermatitis
- Poorly-defined erythema and maceration
- Secondary infections are common

Seborrhoeic dermatitis
- Greasy white or yellow scales occurring over patches of inflamed erythematous skin
- Most commonly affected sites include the scalp, glabella, nasolabial folds and hair-bearing face and postauricular folds; can also affect the axillae and groin

Tinea cruris
- Well-circumscribed scaly plaque with a raised border and central clearing that usually begins in the inguinal fold
- May extend to the inner aspect of the thigh, lower abdomen or pubic area (penis, scrotum and vulva usually spared)

of potential diagnoses usually able to be narrowed on the basis of clinical features. Key features of the most common intertriginous skin disorders in adults are summarised in Box 1.

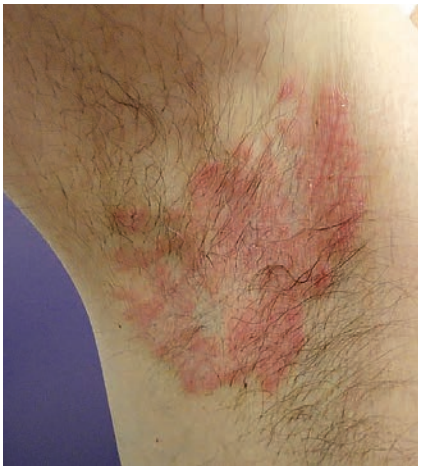

Figure 1. Inverse psoriasis affecting the axilla.

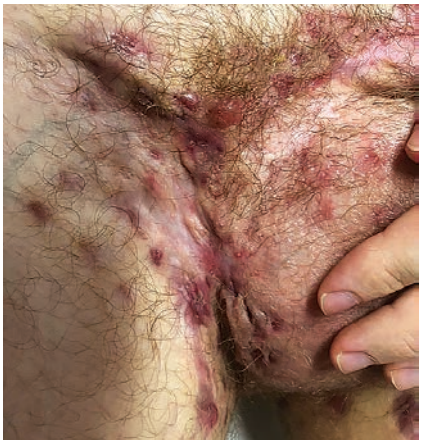

Figure 2. Hidradenitis suppurativa affecting the groin.

History

A thorough history provides useful diagnostic information, with the patient's age and the duration and clinical course of the condition being key components. Some intertriginous skin conditions are more commonly seen in the paediatric population, such as bullous impetigo, cutaneous candidiasis, seborrhoeic dermatitis, viral warts and Langerhans cell histiocytosis.[2-4] A genetic condition will first present at birth or in childhood. Acute onset suggests a primary infective process or drug eruption. A chronic, relapsing course may suggest a chronic inflammatory disorder such as psoriasis (Figure 1) or hidradenitis suppurativa (Figure 2).[5]

Associated signs and symptoms should be noted. Pain and itch tend to be common features of intertriginous skin conditions. Classic painful disorders include furuncles, hidradenitis suppurativa, metastatic Crohn's disease, Hailey-Hailey disease and pemphigus vegetans.[6-8] Itch is frequently seen with scabies, dermatitis, tinea cruris, cutaneous candidiasis, extramammary Paget's disease, granular parakeratosis (Figure 3) and Fox-Fordyce disease.[9-11] In Dowling-Degos disease, freckle-like pigmentation is often seen.[12] Pseudoxanthoma elasticum may present with peripheral circulatory and upper gastrointestinal symptoms, and angioid streaks may be seen on retinal examination.[13]

A number of systemic diseases are associated with intertriginous skin disorders. People who have diabetes mellitus are more likely to develop cutaneous candidiasis, acanthosis nigricans (Figure 4) , erythrasma (Figure 5) and acrochordons than people who do not have diabetes.[14] Patients with HIV infection are more likely to develop seborrhoeic dermatitis, especially in a generalised distribution.[15] Extramammary Paget's disease is sometimes associated with an underlying internal malignancy.[9]

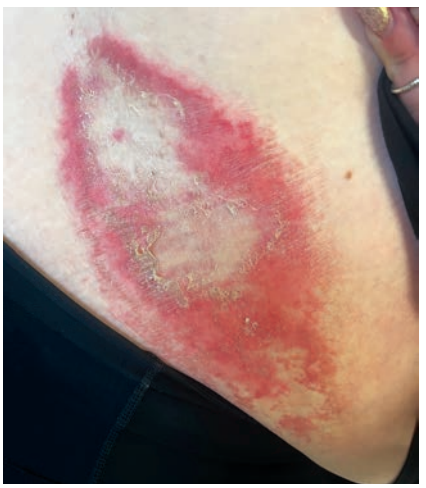

Figure 3. Granular parakeratosis of the abdominal fold.

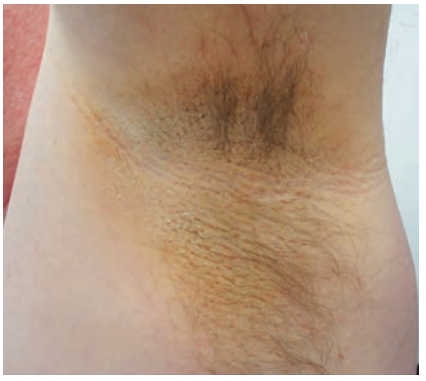

Figure 4. Acanthosis nigricans.

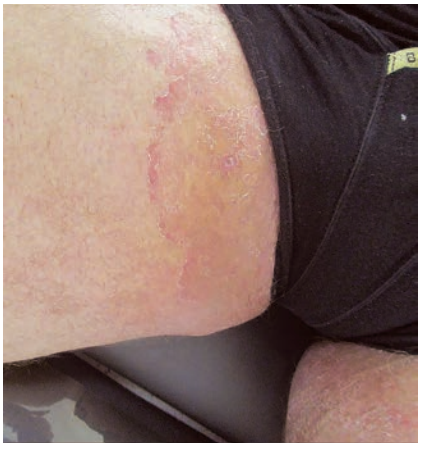

Figure 5. Erythrasma affecting the bilateral groin.

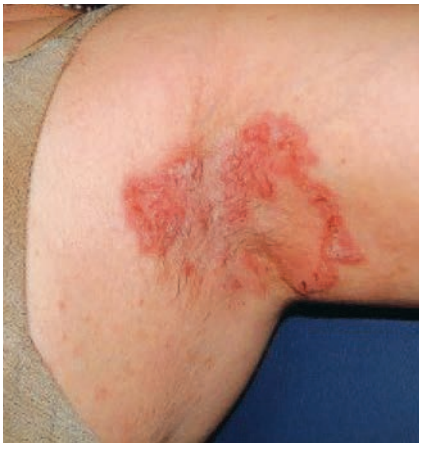

Figure 6. Hailey-Hailey disease affecting the axilla.

Reviewing a patient's current and (recent) past medications is important to identify or exclude an allergic drug eruption or immunosuppressant-associated infective dermatoses.[16] For certain conditions, such as contact dermatitis, identification, cessation and avoidance of a culprit agent is essential for management; therefore, taking a thorough history to identify exposure to potential skin irritants or allergens is essential, such as new soaps, topical creams, laundry detergents and rinses, as well as occupational substances. The allergic type of contact dermatitis is not as common as the irritant type. Infectious contacts should be noted, as patients with scabies, tinea, impetigo or boils may report family members or household contacts having similar skin symptoms.

A family history may provide important clues to the diagnosis, as conditions such as psoriasis, hidradenitis suppurativa, Hailey-Hailey disease (Figure 6), Dowling-Degos disease and pseudoxanthoma elasticum often run in families.[7,12,13]

Examination

Assessment of lesion morphology and distribution are key components of the clinical examination, with morphological features being possibly the single most important aid to diagnosis (Table 1). The distribution of the rash may provide further clues. Infective and malignant processes are typically unilateral and involve only a single or limited number of areas, whereas genetic and inflammatory disorders are usually symmetrical and affect multiple areas.

Intertriginous rashes commonly involve non-intertriginous skin, so an examination of the whole body can provide useful diagnostic information. Psoriasis commonly affects the scalp, natal cleft and extensor limbs. Seborrhoeic dermatitis often involves the scalp, nasolabial folds and eyebrows. The violaceous papules of lichen planus are usually seen on the flexor wrists and ankles.[17] Scabies typically affects the finger web spaces, flexor wrists, periareolar skin and male genitalia. Pseudoxanthoma elasticum is most commonly seen on the neck.[13] A herald patch may be observed in pityriasis rosea. Bacterial folliculitis is often limited to hair-bearing areas. Ensuring adequate

TABLE 1. INTERTRIGINOUS SKIN DISORDERS: TYPICAL MORPHOLOGY

Morphological feature	Relevant conditions
Erythematous patches/ plaques	• Common: irritant contact dermatitis, seborrhoeic dermatitis, inverse psoriasis, tinea cruris, erythrasma, allergic contact dermatitis, pityriasis rosea • Less common: lichen planus • Rare: extramammary Paget's disease, Langerhans cell histiocytosis, necrolytic migratory erythema, pellagra
Hyperpigmentation	• Common: acanthosis nigricans • Rare: confluent and reticulated papillomatosis, Dowling-Degos disease, pellagra
Pustules	• Common: bacterial folliculitis, cutaneous candidiasis • Rare: pemphigus vegetans
Blisters, erosions or ulcers	• Common: bullous impetigo • Rare: Hailey-Hailey disease, metastatic Crohn's disease, necrolytic migratory erythema, pellagra
Discrete papules	• Common: acrochordon, scabies (often excoriated) • Rare: Fox-Fordyce disease, pseudoxanthoma elasticum
Verrucous or hyperkeratotic papules or plaques	• Common: viral warts, seborrhoeic keratoses • Less common: granular parakeratosis, pemphigus vegetans • Rare: condylomata lata
Nodules	• Common: boils, hidradenitis suppurativa

TABLE 2. INTERTRIGINOUS SKIN DISORDERS: EXAMPLES OF FIRST-LINE MANAGEMENT*

Disorder	Common treatments	
Acanthosis nigricans	• No specific treatment required • Underlying causes (e.g. diabetes mellitus) should be treated • Screen for malignancy may be required, depending on presentation	
Acrochordon	• No specific treatment required • Cryotherapy, excision and diathermy are treatment options	
Bacterial folliculitis/boils	Mild/limited	Topical mupirocin or clindamycin
	Severe/extensive	Oral dicloxacillin or cephalexin
Bullous impetigo	Mild/limited	Topical mupirocin
	Severe/extensive	Oral dicloxacillin or cephalexin
Contact dermatitis – allergic	• Identification and removal of suspected allergen • Topical or oral corticosteroids may hasten recovery	
Contact dermatitis – irritant	• Advice to avoid suspected irritant • Emollients and topical corticosteroids may hasten recovery	
Cutaneous candidiasis	Mild/limited	Topical clotrimazole ± hydrocortisone
	Severe/extensive	Oral fluconazole or itraconazole
Erythrasma	Mild/limited	Topical clindamycin or erythromycin
	Severe/extensive	Oral clarithromycin or erythromycin
Granular parakeratosis	• Identification and removal of any contact irritants or provoking factors are key • Topical corticosteroid ± vitamin D analogue may be trialled	
Hidradenitis suppurativa	Mild (Hurley stage I)	Topical clindamycin and topical antiseptic wash
	Moderate to severe (Hurley stage 2 or 3)	Referral to dermatologist
Inverse psoriasis	Mild/limited	Weak topical corticosteroid ± topical antifungal e.g. hydrocortisone 1% with clotrimazole 1%
	Severe/extensive	Referral to dermatologist
Pityriasis rosea	• No specific treatment required • A medium-potency topical corticosteroid can be used to treat itch, depending on severity and/or patient preference	
Seborrhoeic dermatitis	Mild/limited	Topical azole, e.g. ketoconazole ± hydrocortisone
	Severe/extensive	Oral fluconazole, itraconazole or terbinafine
Seborrhoeic keratoses	• No specific treatment required • Cryotherapy, shave excision, curettage or electrocautery can be used	
Tinea corporis, tinea cruris	Mild/limited	Topical clotrimazole ± hydrocortisone
	Severe/extensive	Oral terbinafine or itraconazole
Viral warts	• Treatment not always necessary, especially in children • Topical salicylic acid and cryotherapy good first-line options	

* This is not an exhaustive list of common first-line treatments. For detailed management of intertriginous skin disorders, readers are referred to Therapeutic Guidelines Dermatology 2022 (www.tg.org.au).

examination of sites such as inframammary areas and abdominal folds, as well as the contralateral site, should be a part of a complete assessment.

The patient's nails should also be examined. Nail changes such as discolouration, hyperkeratosis and onycholysis may accompany tinea corporis or tinea cruris. Common nail changes in psoriasis include oil drop appearance, onycholysis, pitting and subungual hyperkeratosis. Lichen planus may be associated with nail ridging and onycholysis. Longitudinal leukonychia occurs in around 70% of patients with Hailey-Hailey disease.[7]

Simple office tests can provide useful information. For example, dermoscopy can aid in the visualisation of burrows as well as the highly characteristic 'delta wing' sign (arrowhead shape that represents the head of the mite and its burrows) in the diagnosis of scabies. Wood's lamp examination may be useful to confirm erythrasma, with coral pink fluorescence being characteristic.

Investigations

After a careful history is taken and physical examination conducted, additional testing may be required if the diagnosis remains uncertain or if there is a need to confirm a preliminary diagnosis. For example, skin scrapings for microscopy and culture may be needed to confirm a diagnosis of scabies or exclude fungal infection in undifferentiated conditions with scale. Bacterial microscopy, culture and sensitivity testing may be needed for pustular or blistering lesions. Direct immunofluorescence testing can be useful for suspected autoimmune blistering diseases.

Skin biopsies are not usually needed and are reserved for patients with an uncertain diagnosis, such as those with an atypical presentation, or for situations where earlier investigations have not yielded sufficient information or histopathological examination is required to confirm a diagnosis.

Management

Management of most intertriginous skin disorders can be initiated in primary care, with the approach depending on the extent and severity of disease (Table 2). Failed response to adequate treatment should prompt reconsideration of the diagnosis.

2. URGENT INTERTRIGINOUS SKIN DISORDERS

A handful of intertriginous skin disorders are potentially life threatening and should not be missed. For these conditions, early referral to a specialist for review and management is necessary.

Extramammary Paget's disease
Extramammary Paget's disease is a rare intraepithelial adenocarcinoma commonly mistaken for dermatitis. It occurs mostly in the elderly and is more frequently seen in women. It presents as an erythematous patch or plaque, most commonly in the anogenital area and less commonly in the axilla. Extramammary Paget's disease can be associated with underlying internal adnexal or visceral malignancy, which is important to exclude in all patients.[18]

Langerhans cell histiocytosis
Langerhans cell histiocytosis is a rare disorder primarily seen in children aged 1 to 3 years. Skin disease, which is seen in 40% of patients, is most commonly an eczematous rash resembling purpuric papules and seborrhoeic dermatitis in flexures or ulcerated lesions in the axillae, inguinal folds, genitalia or perianal region. Evaluation for involvement of other organ systems (e.g. bone, lung, liver, spleen, lymph nodes, bone marrow) is essential, as 90% of patients have multisystem involvement.[4,19]

Necrolytic migratory erythema
Necrolytic migratory erythema is a paraneoplastic reaction usually associated with glucagonoma in individuals over the age of 50 years. It begins as erythematous papules and plaques with subsequent blistering and crusting, most often affecting the perioral region and extremities but it can also involve the anogenital region and buttocks. Pain and pruritus are common. The mucous membranes are also typically affected and patients often have systemic involvement with diabetes mellitus and gastrointestinal and constitutional symptoms.[20]

It can be helpful to ask whether a patient has tried any therapies prior to presentation, as this can guide management. Preparations that patients may have tried include over the counter topical zinc oxide preparations and antifungal creams.

Referral

Referral to a dermatologist is warranted for a patient with an uncertain diagnosis, disease that is severe or recalcitrant to treatment, a suspected first presentation of a genetic disorder or an urgent condition (Box 2).[18-20] A lower threshold for referral should be exercised for children. A patient who is systemically unwell requires emergency department referral.

Conclusion

Intertriginous skin disorders are mostly benign but, rarely, can represent life-threatening disease. They may be difficult to diagnose because friction and maceration can alter their characteristic appearance, but the majority of cases can be diagnosed primarily on the basis of a careful history and examination. Lesion morphology is possibly the single most important diagnostic aid. Most intertriginous skin disorders can be successfully diagnosed and managed in the primary care setting, with certain cases referred for specialist opinion. MT

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COMPETING INTERESTS: None.

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Cosmetic laser and light therapies

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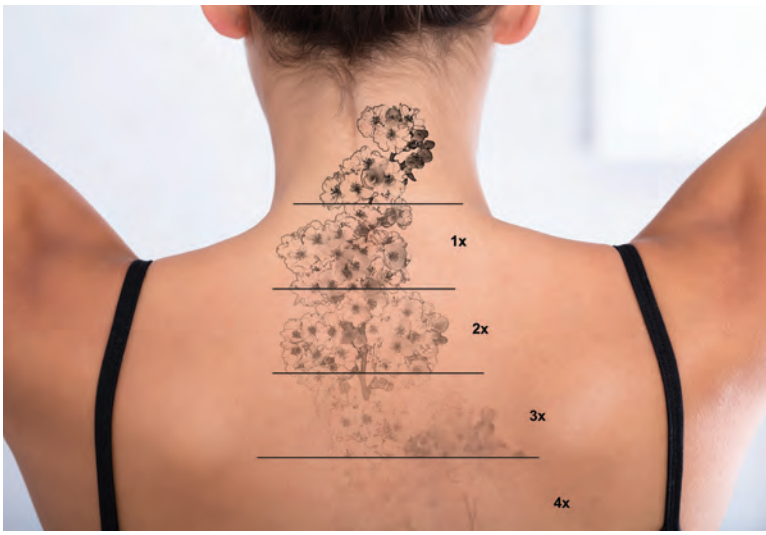
Patients often consult GPs about aesthetic concerns, but cosmetic medicine, including laser therapy, is rarely taught in medical school. Lasers can be used for treating common cosmetic problems by emitting energy of an appropriate wavelength to be absorbed by a specific target or chromophore in the skin. As laser and laser-like devices for cosmetic purposes do not require TGA approval, clinicians should critically evaluate the safety and efficacy of any intervention before recommending it to patients.



Laser (light amplification by stimulated emission of radiation) can be used in dermatology for its photothermal and photoacoustic properties. Laser energy depends on the principle of exponential light amplification through stimulated emission of photons. Each type of laser has a specific gain medium that gives it unique characteristics. An external power source excites the gain medium, leading to electron movement between the orbital shells of the affected atom and subsequent release of the energy in the form of photons (Figure 1).[1] These photons will energise other atoms, triggering rapid multiplication of photons and exponential light amplification.[1] The photons are amplified by mirrors within the device until they are released by the operator.

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Laser beams were originally released as continuous streams of energy, but they are now pulsed (repetitive 'on-off' delivery) for better safety and control. Developments in technology have permitted laser pulse durations of picoseconds, which can also enact damage through photoacoustic energy.[2]

Chromophores, such as melanin and haemoglobin, are biochemical entities that absorb light at specific frequencies. The radiation produced by laser or light therapy can be manipulated to selectively target and destroy specific chromophores, while sparing the surrounding tissue. It is important that the irradiated area is able to dissipate heat, to reduce collateral damage to surrounding tissue and subsequent adverse outcomes.[1] Both haemoglobin and melanin largely absorb light energy at wavelengths below 620 nm.[3] Lasers of wavelengths above 1200 nm predominantly target water in the epidermis and superficial dermis.[3]

This article gives an overview of laser and light-based modalities for treating common cosmetic problems. Broad categories of laser and light devices include intense pulsed light (IPL), vascular lasers, pigment lasers and ablative and nonablative lasers. When selecting a laser for cosmetic indications, consideration must be given to the patient's skin characteristics, treatment goals and the appropriate laser parameters.

Laser types and indications

Intense pulsed light

Although commonly referred to as a laser, IPL is a filtered flash lamp device that comes under the broader category of light therapies. It emits noncoherent polychromatic radiation with wavelengths between 420 and 1300 nm (Figure 2).[1]

IPL can be used for treating vascular lesions, dyschromia and lentigines, as well as for hair removal.[1,4] Evidence suggests it may also be helpful in skin rejuvenation through alteration in gene expression, although it is not known how durable the response is over time.[5]

Vascular lasers

Vascular lasers target haemoglobin (oxyhaemoglobin) and can be used to treat rosacea, facial telangiectasia, angiomas,

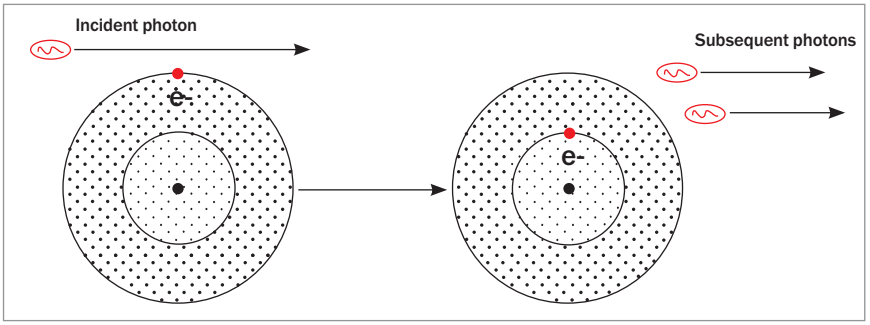


Figure 1. An incident photon giving energy to an excited atom, leading to the release of subsequent photons.
Adapted from Stewart N, et al. Aust J Dermatol 2013; 54: 173-183.[1]

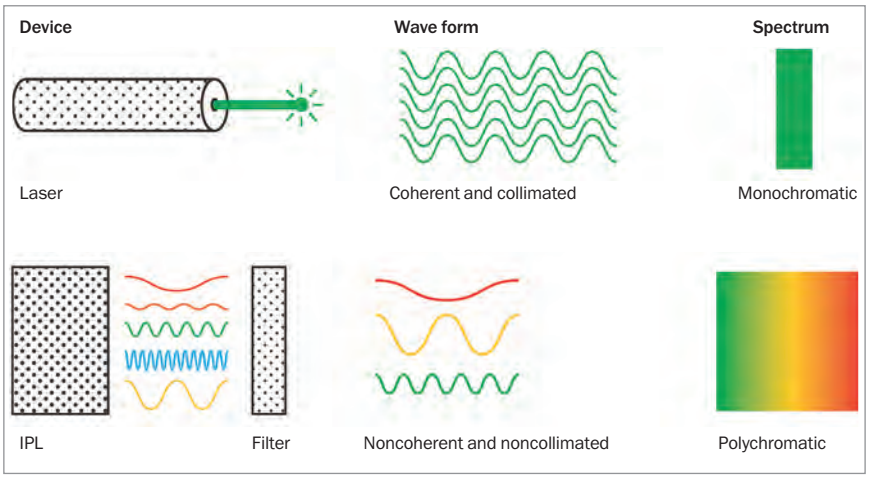
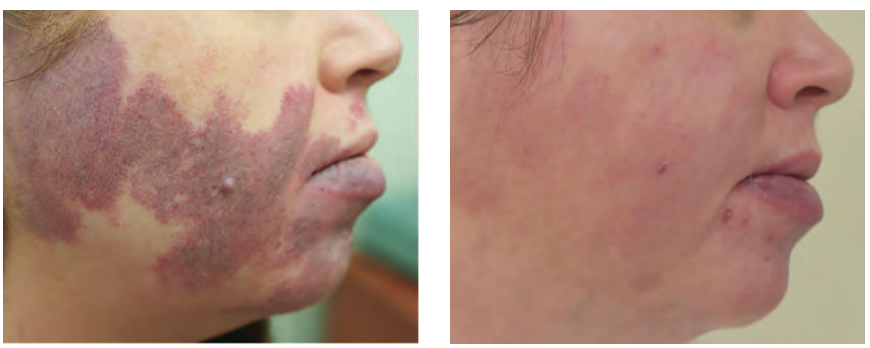


Figure 2. The features of laser and intense pulsed light (IPL).
Adapted from Stewart N, et al. Aust J Dermatol 2013; 54: 173-183.[1]

spider naevi, angiokeratomas, infantile haemangioma and other vascular anomalies (Figures 3a and b).[1,4,6] Device settings should be directed by the size and depth of the target vessel.

Both pulsed dye lasers and potassium-titanyl-phosphate lasers have wavelengths (585 to 595 nm and 532 nm, respectively) that correspond well with the absorption peak of oxyhaemoglobin and are effective in treating capillary and vascular lesions.[7] Neodymium-doped yttrium-aluminium-garnet (Nd:YAG) lasers have a longer wavelength of 1064 nm, which better targets larger-calibre blood vessels and venules because it has deeper penetration into the dermis.[1]



Figures 3a and b. Before (a, left) and after (b, right) vascular laser treatment of a capillary malformation of the face.
Images courtesy of Associate Professor Deshan Sebaratnam, uRepublic Cosmetic Dermatology & Veins, Sydney.

Pigment lasers

Lasers of various wavelengths (including 532 nm, 694 nm, 755 nm and 1064 nm), as well as nonlaser devices like IPL, can be used to treat pigmentary disorders, as melanin preferentially absorbs wavelengths below 1000 nm and does not have an absorptive peak.[1] Pigment lasers can be used to treat brown freckles (lentigines and ephelides) and pigment birthmarks (café-au-lait macules, naevus of Ota and congenital dermal melanocytosis [formerly known as Mongolian spots]) and for hair and tattoo removal.[1,4] Although melasma is a common pigmentary disorder, laser treatments are variably and unpredictably efficacious for this condition.[8,9] Patients treated with pigment lasers for melasma can experience recurrence soon after treatment, as well as undesirable postinflammatory hyperpigmentation.[8,9]

Patients with darker skin are at higher risk of adverse effects, and long-wavelength lasers are recommended to reduce superficial uptake of laser energy and risk of dyspigmentation in this group.[4,10] Laser therapy is not recommended for treating melanocytic naevi as it may mask the development of malignant melanoma; surgery remains the gold-standard treatment for this.[4,11]

Hair removal

Laser therapy can be used to selectively target melanin within germinative cells in the hair follicle, leading to swelling, apoptosis and necrosis of the follicle cells from laser-induced thermal injury.[12] This causes permanent stable hair reduction over several sessions.[13] Various lasers can be used for this purpose, including 810 nm diode, 755 nm alexandrite and 1064 nm Nd:YAG lasers, with the latter preferred for

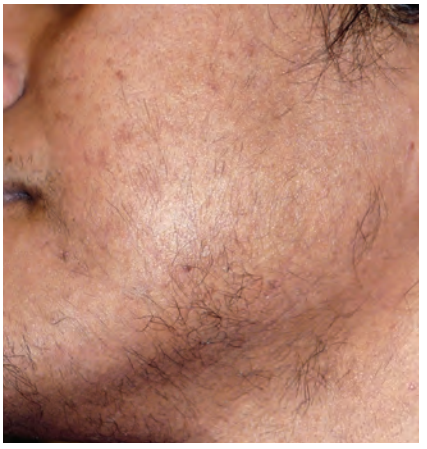
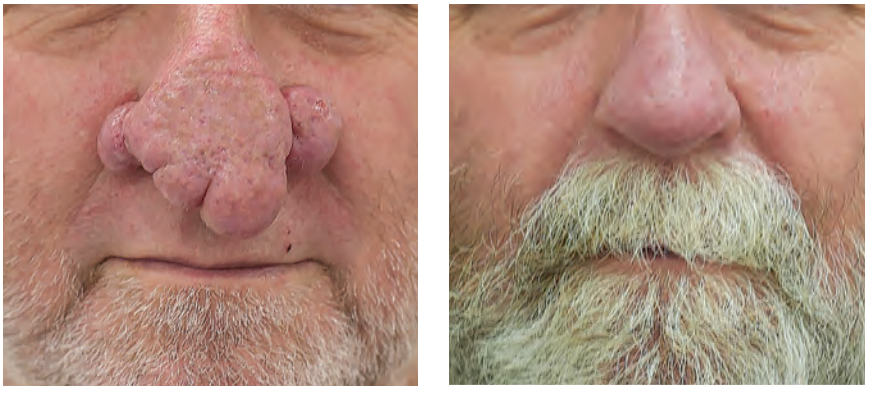


Figure 4. Paradoxical hypertrichosis experienced by a patient after laser hair removal.
Image courtesy of Dr Adrian Lim, uRepublic Cosmetic Dermatology & Veins, Sydney.



Figures 5a and b. Before (a, left) and after (b, right) ablative laser treatment of advanced rhinophyma.
Images courtesy of Associate Professor Deshan Sebaratnam, uRepublic Cosmetic Dermatology & Veins, Sydney.

people with pigmented skin because of its longer wavelength.[4] As melanin pigment is the fundamental chromophore, pigmentary side effects are more common in people with darker skin types, and white hair without melanin pigment will not be laser-responsive. Paradoxical hypertrichosis (where the hair regrows thicker and denser) is an uncommon but often distressing reaction after laser hair removal (Figure 4). However, continued therapy may lead to eventual reduction in hair growth.[12]

Tattoo removal

Professional tattoos are created by deposition of exogenous (nonmelanin) pigment into the dermis. To remove tattoos, rapid pulses of laser energy, generated by nanosecond or picosecond devices (with wavelengths of 694 nm, 755 nm or 1064 nm), are required to shatter the tattoo pigment with photoacoustic (rather than thermal) effects.[14] These devices progressively clear tattoo ink by photoacoustic shattering of tattoo granules into increasingly smaller fragments to permit clearance via the macrophage-lymphatic system.[4,14]

It is recommended to familiarise the patient with the tattoo removal process by performing it on a test patch. Patients also need to be advised that multiple sessions (from five to 20) are likely to be needed, with black tattoos being far more responsive to removal than coloured tattoos.[4]

Ablative resurfacing lasers

Ablative lasers produce rejuvenating effects by using thermal energy to vaporise water within skin cells, leading to healing and remodelling of denatured proteins.[15] These devices include carbon dioxide (CO_2) lasers, which have a wavelength of 10,600 nm, and erbium-doped yttrium-aluminium-garnet (Er:YAG) lasers, which have a wavelength of 2940 nm. Although extremely effective, CO_2 lasers involve a longer healing period and have a higher risk profile, including risk of dyspigmentation, particularly in darker-skinned people.[4] Er:YAG lasers, in contrast, are absorbed by water 10- to 16-fold more than CO_2 lasers and produce superficial ablation with less thermal injury.[1] Ablative lasers are used in treating rhytides (facial lines and wrinkles), scars, rhinophyma and exophytic lesions, such as seborrheic keratosis, epidermal naevi and dermatosis papulosa nigra (Figures 5a and b).[4]

Fractionated lasers

Fractionated lasers are an adapted form of ablative lasers. They deliver thermal injury in multiple discrete vertical cylinders, or microchannels, leaving spared islands of intervening tissue. As these reservoirs are spared from thermal damage, they offer nutritional support to the cells and can act as structural support for keratinocytes and fibroblast migration.[1] Fractionated lasers can be ablative (tissue vaporising) or nonablative (tissue coagulating). They can be used to treat photodamaged skin, mild rhytides and acne scarring. Patients favour fractionated lasers, as they have less propensity for causing prolonged erythema and dyspigmentation. They also require less downtime (three to seven days), compared with traditional nonfractionated lasers. However, multiple treatments may be required.[4]

Treating scars and skin texture problems

Scarring and skin textural changes are responsive to ablative and fractionated laser resurfacing. Not all scars are the same, and treatment is determined by scar type, morphology and severity. For acne scarring, algorithms describing different therapeutic interventions depending on scar subtype have been published, but fractionated lasers are the mainstay of therapy.[4] A common misconception is that patients must wait six months after isotretinoin treatment to receive laser therapy. However, the consensus is that most lasers can be safely used as soon as acne is controlled (including fractionated lasers and excepting fully ablative lasers).[16] It should be emphasised that no scarring will be completely removed with any procedural therapy, and progress is typically modest and incremental in gain.

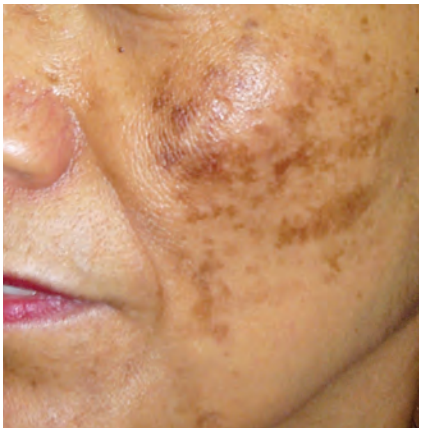


Figure 6. Postinflammatory hyperpigmentation from superficial intense pulsed light burns on the left cheek of a patient with darker skin type.
Image courtesy of Dr Adrian Lim, uRepublic Cosmetic Dermatology & Veins, Sydney.

Multimodal treatment

Using one treatment modality at a time is recommended for new practitioners. With experience, clinicians can begin to combine laser therapy with other cosmetic treatments, including fractional radiofrequency, muscle relaxants or fillers.[4] IPL is often combined with pulsed dye vascular laser therapy for patients with a mix of lentiginous change and erythema. Similarly, for patients with rhinophyma, CO_2 laser therapy is often used in combination with Er:YAG laser therapy and electrodessication. Topical sirolimus is being increasingly used in combination with vascular laser therapy for patients with capillary malformations.[17]

Risks of laser therapy

Downtime is to be expected from most laser procedures, especially with resurfacing lasers, as components of the skin are intentionally damaged and require time to regenerate. It is important to inform people with darker skin, especially those with a Fitzpatrick skin type of IV to VI, that they have much higher risks of burns, dyspigmentation (postinflammatory hyperpigmentation), textural changes and scarring (Figure 6). The higher quantities of melanin in darker skin mean that a greater proportion of energy is absorbed by the constitutional background melanin. As a consequence, lower amounts of residual energy reach the target tissue, which increases the risk of burns and reduces therapeutic efficacy.[4] There is also an increased basal melanocytic activity that predisposes darker-skinned people to postinflammatory hyperpigmentation. To reduce these risks, use of laser platforms with longer wavelengths and conservative power settings is recommended, with an emphasis on cooling devices to counteract the total accumulated heat energy.[1]

Adverse effects and management

Common transient side effects should be explained to the patient before the procedure. These include:[4]

- pain
- pruritus
- erythema
- purpura
- mild oedema
- acne
- vesiculation
- crusting
- temporary pigment changes.

They may occur with more aggressive treatment protocols but can be expected to fully resolve. More serious adverse effects include thermal burns, scarring, dyspigmentation (hypopigmentation and hyperpigmentation) and ocular damage.[4,18]

As with any medical consultation, a full medical history is required. For example, certain pigment lasers are contraindicated for patients who have taken gold (e.g. for arthritis), and a history of herpes simplex mandates antiviral prophylaxis for patients receiving ablative laser therapy.[18] It is pertinent to establish if the patient has a history of previous skin-coloured or black-ink tattoos, as the pigments used can interact with the laser therapy and result in paradoxical darkening or burns, respectively.[19,20] Any previous scar camouflage tattoo or tattoo pigment can act competitively and cause uneven distribution of light and pigmentation.[4] Improper postprocedural care also increases the risk of bacterial and viral infections.

Eye protection is always needed to protect the patient from direct and reflective laser or light impact.[10] Ocular complications from laser or light therapy include permanent vision impairment, iris atrophy, cataracts, anterior uveitis, glaucoma, posterior synechiae and pupillary defects.[21] The most common causes of eye injury are improper eye protection or clinicians removing the patient's eyewear to treat areas near the eye.[10,21]

Regulations in the laser industry

Advances in technology and lower production costs have led to a proliferation of light-based therapies. There is often limited evidence-based information on new devices, as they do not need to be approved or supervised by the TGA.[22] The limited regulations and safety precautions in the cosmetic industry can also result in misleading, erroneous or unsubstantiated information.[23] Training on device application is usually provided by the manufacturers, with obvious conflicts of interest.

There are no national guidelines to dictate training, accreditation or certification in laser use, and the field of cosmetic medicine remains largely unregulated.[23,24] Requirements are mandated by individual state or territory legislation (Table). In certain states, anyone who can acquire a laser or light device can start practising. As devices can be easily purchased through the internet, there may be operators practising without the assurance of adequate training and regulation.[22] In 2021, the Australian Health Practitioner Regulation Agency and Medical Board of Australia announced a review of patient safety in the cosmetic sector, in response to serious complications caused by registered health practitioners.[26]

General approach

Complications are inevitable with laser therapy, even for experienced physicians. Idiosyncratic patient-specific response is difficult to predict and should be explained to the patient as part of informed consent

TABLE. LICENSING REQUIREMENTS FOR NONMEDICAL PRACTITIONERS TO OPERATE LASER AND INTENSE PULSED LIGHT DEVICES FOR COSMETIC PURPOSES[22,23,25]

State/territory	Lasers	Intense pulsed light
Tasmania	Licence required (*Radiation Protection Act 2005*, Radiation Protection Regulations 2016)	Licence required
Western Australia	Can only be used by: • registered medical practitioners • Division 1 Nurses with AHPRA who have attended a recognised laser safety course • nonmedical practitioners or nurses who have attained a licence for hair removal, superficial cosmetic procedure or tattoo removal in a setting where protocols and procedures have been established by a medical practitioner *(Radiation Safety Act 1975)*	Licence not required
Queensland	Licence required (*Radiation Safety Act 1999*, Radiation Safety Regulation 2010)	Licence not required
Australian Capital Territory	Licence not required	Licence not required
New South Wales	Licence not required	Licence not required
Northern Territory	Licence not required	Licence not required
South Australia	Licence not required	Licence not required
Victoria	Licence not required	Licence not required

Abbreviation: AHPRA = Australian Health Practitioner Regulation Agency.

for the proposed procedure.[18] Nevertheless, risk minimisation strategies should always be adopted, and there should be a clear management pathway to deal with common and uncommon adverse events. If a lesion is suspicious for an underlying medical condition, it is important not to conduct any laser treatment, as this can aggravate or disguise the underlying condition. Further investigation or referral to a specialist should be considered.

A suggested approach to laser therapy is as follows.

- Conduct appropriate patient screening:[10]
  - correct diagnosis of lesion (if there is uncertainty about the diagnosis, the lesion should not be treated)
  - Fitzpatrick skin phototype
  - medical conditions (e.g. lupus, koebnerising skin conditions such as vitiligo or psoriasis, herpes simplex, keloid scars)
  - previous cosmetic or surgical procedures, including fillers, tattoos, radiotherapy and skin grafts
  - allergies
  - recent/regular/planned sun exposure or recent sunburn
  - full medication history (including photosensitising medications or supplements)
  - pregnancy and breastfeeding status for women of childbearing age
  - application of fake tan within the previous two weeks
  - waxing, epilation or use of hair removal creams within the previous two months.

TIPS FOR GPS

- It is hard to keep up with the latest in cosmetic medicine offerings, and GPs are not expected to be familiar with all procedures about which patients may enquire. If necessary, GPs can speak to their peers and specialist colleagues and get back to the patient with advice.
- It helps to be nonjudgmental; patients may not declare their cosmetic procedures or be reluctant to seek help for complications from procedures performed by nonmedical operators, for fear of being judged.
- Patients with body dysmorphic disorder can be particularly challenging because of their tendency for 'doctor shopping' and overtreatment from multiple service providers, and dialogue between referring GPs and cosmetic practitioners may be needed to safeguard patient welfare.

- Explain the proposed procedure and ensure the patient has realistic expectations
- Take preprocedural photographs
- For some treatments, conduct patch testing on a small area of skin at least 48 hours before the procedure to reduce the chance of adverse reactions (some clinicians may prefer to patch test as early as six weeks beforehand to ensure efficacy of the intended treatment)
- Make appropriate selection of laser or light device and settings:
  - follow treatment guidelines
  - ensure selection of appropriate treatment parameters, including laser wavelength and mode; do not target unnecessary tissue.
- Follow treatment protocol:
  - inform patients of expected side effects, recovery time, costs, likely number of treatments and duration of intervals between sessions
  - ensure skin is clean and dry (patients should be advised not to apply any cosmetic products to the treatment area for 12 hours before the procedure)

  - ensure adequate cooling, especially for patients with darker skin.
- Take postprocedural photographs and provide postprocedural care:
  - give the patient written information about aftercare, including the importance of hygiene to prevent infection and any products that should be avoided
  - discuss symptoms or signs that warrant medical review and how that should be arranged
  - organise follow up to assess the patient's progress
  - explain to the patient that patient-specific response is an uncontrollable variable that can lead to complications, but optimal care will be offered.

When should a GP refer?

GPs should refer a patient to a dermatologist before laser therapy when there is doubt about the diagnosis of a skin lesion. There are many causes of facial erythema beyond rosacea and photodamage, and pigmented lesions must have a clinical diagnosis before treatment. Different cosmetic dermatoses may require use of different lasers, and undue harm can result if the lesion is incorrectly treated. A 2012 Radiation Health Committee survey found that 62 cases of skin cancer were missed or delayed in a 12-month period in Australia because of incorrect treatment with laser or IPL therapy, leading to unnecessary morbidity.[22]

GPs should also refer patients with significant complications arising from laser therapy for specialist management. Cosmetic GPs should refer patients if they do not have the right modality to treat a particular condition.[23] Practice tips for GPs are provided in the Box.

Conclusion

When used appropriately, modern laser technology is a valuable therapeutic option that can target and treat a wide range of cosmetic dermatoses. Procedures are generally effective and safe when patients are suitably selected and when the appropriate laser is used for the correct indication by a properly trained operator. As laser and light devices for cosmetic purposes do not need TGA approval, clinicians should critically evaluate the safety and efficacy of these devices before recommending their use to patients. MT

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A woman with rosy cheeks and erythematous facial lesions

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Test your diagnostic skills in our regular dermatology quiz. What is the cause of this patient's inflammatory facial lesions and background erythema?

Case presentation

A 57-year-old woman presents with a history of several months' duration of erythematous papules and pustules on her face with associated skin sensitivity and a stinging sensation. She reports frequent facial flushing, particularly with exercise or after ingestion of spicy foods, tea, coffee and alcohol. She does not have any medical history of note and does not take any regular medications.

On examination, background erythema and erythematous papules and pustules are observed to be affecting the central portion of the patient's face, including her forehead, cheeks, chin and infranasal region (Figure).

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Differential diagnoses

Conditions to consider among the differential diagnoses include the following.

Acne vulgaris

Acne vulgaris, an inflammatory disorder of the pilosebaceous unit, is one of the most common skin conditions, affecting about 85% of adolescents and 9.4% of the global population.[1,2] The pathogenesis involves a complex interplay between increased sebum production and follicular hyperkeratinisation, which results in comedone formation and subsequent proliferation of *Cutibacterium acnes* (formerly *Propionibacterium acnes*) and inflammation. Well-known predisposing factors include family history, androgen excess, insulin resistance and psychological stress.[3-5] There is limited evidence about the role of diet, but some studies have demonstrated an association between acne and dairy or foods with a high glycaemic load.[5-8]

Acne has a predilection for body sites that have a high concentration of sebaceous glands, such as the face, upper back and chest. The condition is characterised by comedones, both open (blackheads) and closed (whiteheads), as well as erythematous and inflamed papules, pustules, cysts and nodules. There may also be postinflammatory hyperpigmentation and scarring (atrophic, boxcar, ice pick, rolling, hypertrophic and keloid).

For the case patient, no comedones are observed on examination. The lesions are concentrated in the central portion of the face, whereas the lesions of acne vulgaris would be expected to be more widespread. Acne is not usually associated with facial flushing.

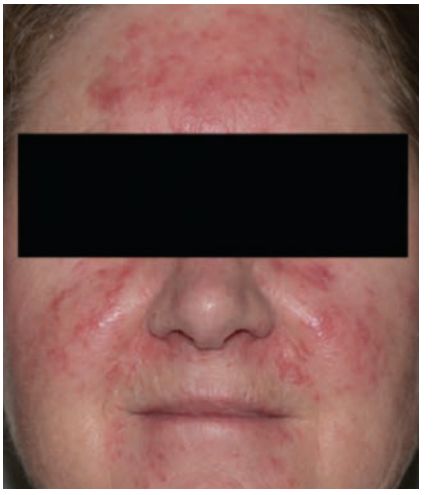

Figure. Centrofacial erythema with erythematous papules and pustules (case patient).

Folliculitis

Folliculitis (inflammation of the hair follicle) can be infectious or noninfectious. Infectious folliculitis is commonly caused by bacteria (*Staphylococcus aureus*, *Streptococcus* spp., Gram-negative bacteria such as *Pseudomonas aeruginosa*) but can also be brought about by fungi (dermatophytes, *Malassezia* spp. [discussed below], *Candida* spp.), viruses (herpes simplex virus, varicella zoster virus) and parasites (*Demodex* spp.). Hair removal (shaving, waxing, epilating, plucking) can inflame the hair

follicles during the removal process, increasing the risk of folliculitis. Other causes of noninfectious folliculitis include irritants (e.g. cutting oils, tar products, other chemicals), occlusion (e.g. by oils, ointments, adhesives) and drugs (e.g. corticosteroids, androgens) as well as immunosuppression (eosinophilic folliculitis in the setting of HIV infection) and inflammatory skin diseases (e.g. folliculitis decalvans). A swab can be taken for microscopy and culture to distinguish between infectious and noninfectious types of folliculitis.

Folliculitis affects body sites with hair. The condition is characterised by tender follicular papules or pustules on an erythematous base. Follicular lesions can be distinguished from their nonfollicular counterparts by the presence of hair piercing the lesions and spatial pattern, which follow the hair follicle distribution.

For the case patient, the erythema is more widespread than perifollicular and the papules and pustules do not have a folliculocentric distribution. Folliculitis is not associated with facial flushing.

Pityrosporum folliculitis

The pathogenesis of pityrosporum folliculitis (also known as *Malassezia* folliculitis) involves follicular occlusion followed by overgrowth of *Malassezia* in a sebaceous environment. Living in a hot, humid climate has been reported as a predisposing factor.[9,10] As *Malassezia* is part of normal skin flora in 90% of individuals, it has been postulated that altered host immunity and immunosuppression may play a role.[11,12] The incidence has been observed to be higher after antibiotic use.[13]

Pityrosporum folliculitis manifests as small, pruritic, monomorphic, folliculocentric papules and pustules on the upper back and chest. Other sites, such as the forehead, hair line and chin, can also be affected, albeit not as often.

Dermoscopic findings include perifollicular erythema, perilesional scales, and hair that is hypopigmented and coiled or looped.[14] Woods lamp examination may show a yellow-green fluorescence. A potassium hydroxide test performed on skin scrapings may show budding yeasts.

For the case patient, the lesions are not pruritic, folliculocentric or monomorphic. There is no associated flushing in pityrosporum folliculitis.

Rosacea

This is the correct diagnosis. Rosacea, a chronic inflammatory dermatosis with centrofacial distribution, has a predilection for women aged between 30 and 50 years, particularly those of Celtic and northern European descent and skin phototype I or II.[15] However, men, darker-skinned individuals and other age groups can also be affected. The global prevalence is estimated to be 5.5%.[16]

The exact pathogenesis of rosacea is unknown but multiple factors are thought to be contributory, including a genetic predisposition and immune and neurocutaneous dysregulation in response to internal and external triggers, which lead to hyperinflammation and the resultant characteristics of rosacea.[17] Common triggers include exposure to ultraviolet radiation, spicy foods, hot beverages, exercise, alcohol, temperature change and psychological stress.[18]

Rosacea has been associated with systemic diseases, including cardiovascular, respiratory and metabolic disorders, neurological diseases (such as Parkinson's disease) and autoimmune disorders (such as rheumatoid arthritis, coeliac disease and multiple sclerosis).[18,19] Further studies are needed to confirm these associations.

Diagnosis

The diagnosis of rosacea can pose a challenge because the condition shares many common features with other facial dermatoses that may be present concurrently, such as those listed above. Traditionally, rosacea was divided into four subtypes: erythematotelangiectatic, papulopustular, phymatous and ocular. However, the global ROSacea COnsensus (ROSCO) panel recently created a new diagnostic and classification system (see Box), to reduce the subtype overlaps frequently seen in clinical practice.[20,21] The case patient fulfils the diagnostic requirement for rosacea with background ongoing centrofacial erythema (diagnostic feature), and the intensification by known triggers further supports the diagnosis. She also has centrofacial flushing, inflammatory papules and pustules (two major features) and a stinging sensation of the skin (minor feature).

DIAGNOSIS OF ROSACEA[20,21]

In accordance with the diagnosis and classification system published by ROSacea COnsensus (ROSCO) in 2019, a diagnosis of rosacea requires the presence of at least one diagnostic feature or two major features. Minor features might also be present with diagnostic and/or major features.

Diagnostic features

- Background ongoing centrofacial erythema, which may intensify in response to triggers
- Phymatous changes: skin thickening, sebaceous glandular hyperplasia, rhinophyma

Major features

- Flushing/transient centrofacial erythema
- Inflammatory papules and pustules
- Telangiectasia (excluding perinasal)
- Ocular manifestations: lid margin telangiectasia, blepharitis, keratitis, conjunctivitis, sclerokeratitis

Minor features

- Burning sensation of skin
- Stinging sensation of skin
- Dry sensation of skin
- Localised facial oedema

TABLE. TREATMENT OPTIONS FOR ROSACEA

Treatment	Notes
General measures	
Photoprotection	
• SPF 50+ sunscreen, preferably tinted • Other photoprotective measures (e.g. wearing a broad-brimmed hat)	• Advised for all patients
Skin care	
• Gentle cleansers and moisturisers, consider products that contain ceramides • Avoidance of exfoliants and products containing alcohol, menthols, camphor, witch hazel, fragrance, eucalyptus oil or peppermint • Avoidance of procedures such as chemical peels and dermabrasion	• Advised for all patients
• Avoidance of triggers, where practical	• Advised to reduce flushing
Medical treatments	
Topical	
• Metronidazole 0.75% gel or cream twice daily	• One of the most commonly prescribed topical agents for rosacea
• Ivermectin 1% cream once daily	• Shown to be more effective and to produce longer remission than topical metronidazole[22,23]
• Azelaic acid 15% gel or 20% lotion once daily	• Shown to have at least equivalent or superior efficacy to topical metronidazole in some studies[24-27]
• Topical alfa2-adrenergic receptor agonist, e.g. brimonidine tartrate 0.33% gel	• Used rarely for erythema/flushing with rapid result; used for special occasions • Can cause rebound erythema; long-term use should be avoided
Systemic	
• Oral antibiotics, e.g. doxycycline 50 to 100 mg daily, minocycline 50 to 100 mg daily, erythromycin 250 to 500 mg twice daily	• Patients should be advised about risk of photosensitivity, particularly with doxycycline (reported risk 3 to 16% at 100 mg daily)[28-30]
• Isotretinoin 10 to 20 mg weekly	• Consider for patients with refractory disease (off-label use)
Procedural management	
• Surgery	• For patients with phymatous changes
• Laser therapies, e.g. pulsed dye laser (for erythema/telangiectasia), ablative laser (for phymatous changes)	• Laser choice depends on main issue to be addressed
Specialist referral	
• Referral to dermatologist	• If there is diagnostic uncertainty or failure of multiple treatment lines; consideration of laser therapy
• Referral to ophthalmologist	• For patients with ocular involvement

Management

Current treatment options for rosacea are outlined in the Table.[22-30] Management requires a holistic approach, and should be individualised according to the main presenting features. The condition is not curable, but it can 'burn out' after several years. It is important that patients are educated about the chronicity of rosacea and its remitting/relapsing nature.

Outcome

The case patient was reviewed by a dermatologist and diagnosed with rosacea. She was advised about the chronicity of the disease and the importance of general skincare measures, photoprotection and trigger avoidance. She had previously tried topical metronidazole cream for a few months with no improvement in her symptoms. Therefore, she was commenced on oral doxycycline 100 mg daily. At one month follow-up, her facial eruption was almost completely cleared. To maintain remission, the doxycycline dosage was reduced to 100 mg every two days, and then further reduced to three times a week. It should be noted that the aim was to reduce the dose of doxycycline to the lowest possible dose that maintains remission (e.g. 50 mg three times a week) but this can vary between patients. In the presented case, the patient developed gastrointestinal discomfort with doxycycline after some time, and her maintenance treatment was changed to low-dose isotretinoin 20 mg twice a week, which has maintained disease remission and been well tolerated. MT

References

A list of references is included in the online version of this article (www.medicinetoday.com.au).

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