The diagnosis, management, and prevention of intertrigo in adults: a review.

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Abstract:

Intertrigo is a common inflammatory skin disorder caused by skin-on-skin friction in skin folds, due to moisture becoming trapped because of poor air circulation. This can occur in any area of the body where two skin surfaces are in close contact with each other. The aim of this scoping review was to systematically map, review and synthesise evidence on intertrigo in adults. We identified a wide range of evidence and performed a narrative integration of this related to the diagnosis, management, and prevention of intertrigo. A literature search was conducted within the following databases: Cochrane Library, MEDLINE, CINAHL, PubMed and EMBASE. After reviewing articles for duplicates and relevance, 55 articles were included. The incorporation of intertrigo in the ICD-11 provides a clear definition and should improve the accuracy of estimates. With regards to the diagnosis, prevention and management of intertrigo, the literature demonstrates consensus among health professionals in approach and this forms the basis for the recommendations of this review: identify predisposing factors and educate patient in reducing these; educate patients in skin fold management and adopt structured skin care routine; treat secondary infection with appropriate topical agent; consider using moisture-wicking textiles within skin folds to reduce skin-on-skin friction, wick away moisture and reduce secondary infection. Overall, the quality of evidence on which to determine the strength of any recommendations for practice remains low. There remains the need for well-designed studies to test proposed interventions and build a robust evidence base.

Declaration of interest:

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Moisture-associated skin damage (MASD) describes the spectrum of damage that occurs as a result of the prolonged exposure of the skin to various sources of moisture, such as urine or faeces, perspiration, wound exudate, mucus or saliva[1,2]. However, MASD is a non-specific umbrella term for a form of contact irritant dermatitis and consists of four separate entities, which often co-exist. These are: incontinence-associated dermatitis (IAD); intertrigo (intertriginous dermatitis); periwound moisture- associated dermatitis; and peristomal moisture-associated dermatitis (Fig 1). Interest in the concept of MASD as a clinical problem has grown over the past decade, with the revised 11th version of the International Classification of Diseases (ICD) now having codes for the separate forms of MASD within the EK02 irritant contact dermatitis section (ICD-11)[3]. While there have been advances in our understanding of MASD, much of this work has focused on IAD. In part, this has been driven by the established association between IAD and the development of pressure ulcers/injury[4–6]

Intertrigo, otherwise known as intertriginous dermatitis (ITD), is a common inflammatory skin disorder that occurs due to skin-on-skin friction in the skin folds, as a result of moisture becoming trapped due to poor air circulation[7–9]. This causes the skin to 'stick' together, thereby increasing friction and leading to skin damage. This can occur in any area of the body where there are two skin surfaces in close contact with each other, such as the interdigital regions, but is more common in the natural large skin folds of the body such as the axillary, inframammary, umbilical, perianal and inguinal areas[7,9,10]. Initially, intertrigo presents as mild mirror-image erythema in the skin folds, but may progress to more severe inflammation with erosion, oozing, exudation, maceration and secondary infection[11]. In many cases, intertrigo becomes a recurrent problem, and a challenge to prevent and manage effectively. A systematic review on the prevention and treatment of intertrigo in adults was published in 2010, which concluded that there was insufficient evidence to guide practice and highlighted the need for more well-designed studies.[8] Therefore, 10 years on, and with intertrigo now having an ICD-11 code (EK02.20), it was decided to review the literature, with the aim of providing a narrative integration of the evidence regarding the diagnosis, prevention and management of intertrigo in adults, and to develop recommendations for clinical practice.

Methods

This scoping review followed the methodology proposed by Arksey and O'Malley[12] to systematically map, review, and synthesise a wider range of evidence than would be included in a formal systematic review. Unlike systematic reviews, a scoping review does not involve detailed critical appraisal of individual studies. The earlier systematic review published by Mistiaen and van Halm-Walters[8] was used as a basis for this review, and therefore the search was limited to the following: literature published between January 2005 and January 2020: human studies, published in English, abstract available, adults (≥18 years). Opinion papers, commentaries and editorials were excluded to reduce bias. Searches were conducted within the following databases: Cochrane Library, MEDLINE, CINAHL, PubMed and EMBASE. The primary search terms used were: Intertrigo, Intertriginous dermatitis, Cutaneous candidiasis, Moisture lesion, Moisture-associated skin damage, and Flexural or intertriginous candidiasis. Citations were followed up in reference lists for key citations. Key current texts were hand searched and relevant previously unidentified sources were followed up to capture literature

not published in academic journals or indexed in databases (grey literature). The literature identified was initially screened from the abstract for relevance and meeting the inclusion criteria and the availability of the full- text. Selected literature was reviewed and summarised using a data extraction form based on the CASP critical appraisal tools[13]. This allowed the categorisation of selected literature according to the following themes:

1. Aetiology and predisposing factors
2. Incidence and prevalence of intertrigo in adults
3. Clinical manifestations of intertrigo
4. Diagnosis of intertrigo
5. Differential diagnoses
6. Effect of intertrigo on quality of life and health economics
7. Prevention, treatment, and management of intertrigo.

Search results

The initial literature search produced 808 articles, with an additional five articles identified from grey literature (conference abstracts/websites). Following removal of duplicates and reviewing the article abstracts/full text for relevance, 55 articles were selected for inclusion (Fig 2). The most common reasons for exclusion were not focusing specifically on intertrigo, reporting specific cutaneous drug reactions, or toe web intertrigo. Apart from the 2010 systematic review,[8] no other systematic reviews were found concerning the management of intertrigo in adults. Studies included consisted of epidemiological reports, and evaluations of different topical treatments, either as case studies or poorly designed trials.

Aetiology and predisposing factors

ICD-11 defines intertrigo as a form of irritant contact dermatitis of the skin folds (axillary, inframammary, genitocrural, abdominal apron) caused by repetitive shearing forces of skin on skin. Sweat, other body fluids, occlusion and obesity all contribute to its development[3]. This can occur in any area of the body where there are two skin surfaces in close contact with each other (Fig 3), with interdigital intertrigo also being common. Predisposing factors that increase the risk of intertrigo include obesity, hyperhidrosis, diabetes, urinary/faecal incontinence, poor hygiene and immunocompromise (e.g., HIV, chemotherapy, systemic steroids). The wearing of tight, restrictive clothing can also contribute, and toe web intertrigo may be associated with closed-toe or tight-fitting shoes and commonly affects persons participating in athletic, occupational or recreational activities. In patients with diabetes, particularly those with type II diabetes, skin surface pH has been found to be higher, particularly in the skin folds susceptible to intertrigo[14,15]. In the obese individual, several factors increase the likelihood of intertrigo developing. Firstly, the skin folds are more pronounced, and skin barrier function is impaired,[16] favouring the development of intertrigo under the abdominal or pubic panniculi. Secondly, the associated problems of increased sweating and reduced dexterity can make it difficult to ensure these areas are kept clean and dry. The link between obesity and intertrigo

is well established, and there is a direct relationship between the degree of obesity and incidence of intertrigo,[16–19] due in part to the disruption in skin function linked to obesity[20]. The rise in postbariatric patients (i.e., morbidly obese patients who have achieved significant weight loss) represents a newer group with a high predisposition to developing intertrigo. Many of these patients are left with significant amounts of excess skin (e.g., panniculus morbidus) and extreme skin folds within which intertrigo often develops[21]

Incidence and prevalence of intertrigo

Accurate incidence and prevalence data for intertrigo remain elusive and the precise size of the problem in the general population is not known. There is often a lack of clarity over methods used, and confusion over what exactly is being reported. Several other factors add to the confusion, such as lack of standard definitions and overlap in medical taxonomies and terms used, such as 'moisture lesion'. It is hoped that the inclusion of intertrigo in the ICD-11 will improve the quality of data in future.

The often-cited incidence and prevalence figures for intertrigo come from a European systematic review of intertrigo in adults conducted in the Netherlands, which suggests a prevalence of 6% in hospital patients, 17% in nursing home residents and 20% in those receiving home care[8]. Similar figures (16.1%) were reported by Hahnel et al.[22] in 2017 in a multicentre prevalence study of skin diseases in German nursing home residents (n=223) based on the ICD-10 classification, and Gabriel et al.[23] who used the same cohort but focused on intertrigo. Interestingly, unlike all other published work, this study found no association with obesity, but intertrigo was associated with the degree of dependency with meeting hygiene needs and increasing age. Özer et al.[24] report a prevalence of 5.3% in Turkish nursing home residents. In contrast, Valls-Matarin et al.[25] report an intertrigo incidence of 15.9% in a Spanish intensive care unit, and Emre et al.[26] a prevalence of 28.9% in a Turkish intensive care unit. In the US, Arnold-Long and Johnson[27] assessed the prevalence and incidence of IAD and intertrigo in patients (n=417) referred to the Wound Ostomy and Continence nurses, on admission, over a three-year period in an acute care community hospital. Compared to the European studies, the prevalence of intertrigo was found to be much higher, with a mean prevalence on admission over the three-year period of 40%. In this study, no significant difference in prevalence was seen between sexes, but there was a strong association with obesity. Interestingly, Arnold-Young and Johnson[27] report a reduction in the prevalence of hospital-acquired intertrigo during this period, which they attribute to the introduction of a skinfold management protocol and associated staff education. Another North American study[28] assessed all forms of MASD in 1427 patients over one year in an acute teaching hospital, finding an overall prevalence of MASD of 4.34%, with intertrigo being the most prevalent form of MASD seen at 2.66%, considerably lower than that reported by Arnold-Young and Johnson.[27] Also, in the US, Storan et al.[29] performed a retrospective chart review of inpatient dermatology consultations and found an intertrigo prevalence of 3.1%.

Several studies directly reporting the cutaneous effects of obesity were found, although in many the exact methods used to calculate incidence/prevalence of skin disease were not clear. Al-Mutairi[17] studied the nature of skin diseases seen in obese adults referred to a hospital dermatology department over one year in Kuwait, finding a prevalence of 22.2%.

Shareef et al.[30] examined a cohort of 100 obese patients over a two-year period attending a dermatology outpatient department in India and reported intertrigo in 60% of the cohort. Similarly, in a Brazilian matched cohort study (n=149) comparing skin disease between obese and individuals with normal body mass index (BMI), Boza et al.,[18] demonstrated a significantly higher prevalence of intertrigo in the obese group (44.7%) compared to normal BMI (6.8%).

Recently, Kottner et al.[31] completed a secondary data analysis of four annual multicentre prevalence studies in the Netherlands. In total the data from 40,340 patients were included, covering care homes, hospitals and those receiving home care. An intertrigo prevalence of 2%, 7% and 10% was reported for hospitals, care homes and home care, respectively. These estimates are in general agreement with other reported data, such as a prevalence of 2.5% reported by Ndiaye et al.[32] in a hospital setting in Senegal, and a prevalence of 3% found in older adults in a long-term care facility in Turkey.[33] Overall, this suggests that the prevalence of intertrigo is variable dependant on care setting, being highest in individuals receiving care in their own homes. Interestingly, Kottner et al.[31] suggest a strong association between the presence of intertrigo and degree of dependency on care staff to maintain hygiene needs.

Clinical manifestations of intertrigo

Initially, intertrigo presents as mild mirror-image erythema in the skin folds, accompanied by pruritis, stinging and burning (Fig 4). This may often progress to more severe inflammation with erosion, oozing, exudation and maceration; secondary infection is a common complication (Fig 5)[34]. The combination of warm, moist and damaged skin provides the ideal conditions for microorganisms to breed and in severe cases polymicrobial infection occurs and may include antibiotic resistant strains[7]. There are few studies directly reporting on the microbiology of intertrigo,[35,36] and these have primarily focused on intertrigo in the feet, and fail to separate out data from other body areas. Interestingly Rao et al.[36] reported multidrug resistance in 25.8% of Staphylococcus isolates and in 9.25% of Gram-negative isolates. Microbiological studies confirm that secondary fungal infections are the most common, due to Candida albicans, and dermatophytes such as Trichophyton, which often complicate interdigital intertrigo. Worryingly, it has been reported that the incidence of more virulent nonalbicans Candida species superficial skin infections has risen by over 50%,[37] suggesting the need to re-examine our understanding of the mycology and bacteriology of intertrigo in large skin folds. Candida infection is usually very itchy, with sharp margins and satellite pustular lesions (Fig 6)[38]. The depth of the skin fold should be fully examined as candidal infections are often associated with fissures, particularly in patients with psoriasis[39,40]. Intertriginous infection by dermatophytes is more common in male patients, with the presence of scaling plaques, vesicles, a circular active border and central clearing being typical features.41 Numerous bacterial species often co-exist, such as Staphylococci, Streptococci (especially group A beta haemolytic Streptococci), Pseudomonas, Proteus mirabilis and Corynebacterium minutissimum (leading to erythrasma, Fig 7). In the case of inguinal and perianal intertrigo, gut bacteria can also be involved, such as Enterococci or Escherichia coli. The presence of ‘fiery’ red lesions, exudate and a foul odour often suggests bacterial rather than fungal infection (Fig 8). If not dealt with effectively, any initial secondary infection in intertrigo can

easily progress into more serious soft tissue infections, particularly in patients with diabetes with interdigital intertrigo in the feet, such as cellulitis, or even lead to sepsis[9,10].

Diagnosis of intertrigo

Although intertrigo is a relatively common skin disorder, it can sometimes be difficult to distinguish from other dermatological conditions that may affect the skin folds. Taking a focused patient history and completing a physical examination can assist in differentiating intertrigo from less common conditions and is important when re-evaluating cases that have failed to respond to initial treatment.

The duration, location, aggravating and ameliorating factors need to be collected in order to assess intertrigo, potential causes and any complications. Sensations, such as itching, burning, smell and pain should systematically be evaluated, as the treatment of these symptoms is also a part of the treatment of intertrigo. In order to rule out a differential diagnosis, past medical personal and family history needs to be collected. A family history of symmetrical vesicles and erosions of the axillae may, for example, lead to the diagnosis of Hailey–Hailey disease. Personal history of psoriasis may lead to the diagnosis of inverse psoriasis. Cutaneous drug reactions should always be ruled out by compiling a full medications history.

The diagnosis of intertrigo can usually be made based on the characteristic physical findings of mirror-image erythema associated with inflammation and erosion in the skin folds. Other skin lesions, such as pustules, should be screened to rule out differential diagnoses (see below). In obese patients, physical examination may be difficult and may require the patient to lay flat, with assistance required to examine the full depth of the skin folds. Physical examination includes a complete skin assessment, including examination of all the integument, mucous membranes, evaluation for intertrigo complications, including secondary infections, and screening for other associated skin disorders. Any contributing factors should be evaluated, such as current skin care regimen and sources of excessive moisture (e.g., urinary and/or faecal incontinence and perspiration).

The diagnosis of intertrigo can usually be made from the history, presentation, and physical examination alone. Skin biopsy is not required to confirm the diagnosis as there are no characteristic histological changes, but it can be helpful when a differential diagnosis is suspected[7,37]. Although the presence of secondary infection is usually determined on clinical examination and treated empirically, confirmation can be obtained by examining skin scrapings under a microscope following the application of potassium hydroxide solution. The presence of hyphae confirms dermatophytic lesions, and the presence of pseudohyphae confirms the presence of *Candida*[37]. Samples may also be sent for formal mycological examination and specific stains used, such as periodic acid–Schiff stain, particularly if an unusual species is suspected and given the rise in antifungal resistance[42]. The use of a Wood's lamp may be useful in the simple determination of secondary bacterial infection, producing a green fluorescence with *Pseudomonas* and coral red with *Corynebacterium minutissimum*.7,10,37 Skin scrapings and swab samples may also be sent for bacteriological culture and sensitivity reporting, particularly in cases unresponsive to initial therapy and treatment, guided by local antimicrobial policy[11,43,44].

Differential diagnoses

As previously discussed, the diagnosis of intertrigo is based on the history and examination alone. However, there are several dermatological conditions that can also affect the skin folds, which need to be ruled out. These range from contact dermatitis caused by antiperspirants/deodorants, cutaneous drug reactions (e.g., baboon syndrome) through to rare diseases such as Hailey–Hailey and Langerhans cell histiocytosis. A summary of differential diagnoses for intertrigo is provided in Table 1.

Effect of intertrigo on quality of life and health economics

The negative impact skin disease can have on quality of life (QoL) is well documented, and several well-validated instruments have been developed to measure this[56]. Although it is suggested that intertrigo, particularly recurrent intertrigo, impairs QoL and has a detrimental psychological impact,[37] no studies could be found that specifically focused on the impact of intertrigo on QoL. Similarly, there would appear to be no studies directly exploring the health economics of intertrigo. Therefore, there is the need for studies to address this deficit, particularly when evaluating new treatment options.

Prevention, treatment and management of intertrigo

Overall, the quality of evidence on which to base specific recommendations for the treatment and management of intertrigo remains low, as previously concluded by Mistiaen and van Halm-Walters[8]. However, from the literature reviewed there would appear to be a growing consensus that provides a basis for the treatment/management and prevention of MASD[57] and specifically intertrigo in adults based on expert opinion[11,58]. Patient/carer education is an important aspect, particularly as many patients will present after self-management has failed. Blackett et al[59] discussed some of the methods patients might use to address the problem, such as placing cloth, tissue, pads and gauze in the skin folds, as well as using talc/ other powders to try to absorb moisture. There is no evidence that any of these measures are effective, indeed they may be detrimental, as any moisture absorption will be limited, and they may further irritate the skin as well as providing a medium for microbiological incubation. However, no studies specifically investigating the effects of powder use on intertrigo could be found. Ideally, any preventative or management strategy should focus on controlling the triad of factors that contribute to the development of intertrigo, namely moisture, friction and microbes. Unfortunately for many patients, intertrigo can become a recalcitrant problem.

Optimal prevention includes minimising skin-on-skin friction, reducing moisture in and around the skinfolds, and keeping high-risk areas clean and dry. Where possible predisposing factors should be addressed, such as weight reduction in obesity, achieving good glycaemic control in diabetes, and incontinence management. Patients should be advised to wear loose, light clothing made from absorbent natural fabrics (e.g., cotton), or athletic clothing designed to wick perspiration away from the skin, and to avoid synthetic fabrics. Attention should be paid to ensuring skin folds are kept clean and dry, with the adoption of a structured skin care regimen. Ideally cleansing should be with a no-rinse pH-balanced cleanser, avoiding the use of alkaline soaps, if possible. Care should be taken to ensure the skin folds are thoroughly dried, without causing excessive friction. The use of skin barrier products to protect the skin

from moisture and reduce friction is recommended, but these are often difficult for patients to effectively apply themselves. To date there is insufficient evidence to guide choice of product. Absorptive powders, such as talc or corn starch, are not recommended to be used,[7,10,11,58] although, as previously stated, no direct evidence to support this could be found. Based on expert consensus opinion, the use of moisture-wicking textiles specifically designed for skin fold management is now recommended for the prevention of intertrigo. These are designed to lie in the skin folds, wick moisture away and allow it to evaporate, keeping the skin fold dry. They also reduce skin-on-skin friction and contain broad-spectrum antimicrobial silver[11,58,60].

Uncomplicated intertrigo should be treated by following the measures outlined above. However, intertrigo complicated by secondary infection will not resolve unless the infection is treated. In all cases treatment should be based on current local antimicrobial policies. Recommendations for treating Candidal infections include the use of topical clotrimazole, nystatin and miconazole preparations, and consideration of systemic therapy (e.g., fluconazole or itraconazole) in severe infections [7,10,37]. In the UK, topical miconazole is recommended as a first-line treatment due to having some Gram-positive bacteriostatic action[11]. Topical antifungal agents generally need to be used for at least two weeks in intertrigo,[61] adding to the burden on patients and caregivers. The addition of low-potency steroids or the use of a combination preparation containing an antifungal and steroid has been recommended, particularly in severe inflammation accompanied by pruritis [10,11]. However, Mistiaen and van Halm-Walters[8] found that there was limited evidence to show systemic therapy was any better than topical, or that corticosteroids were any better than antifungals in reducing inflammation in intertrigo. More recently similar conclusions were drawn by Taudorf et al.[42] in their systematic review on topical and systemic treatments for cutaneous candidiasis. Secondary infection due to bacteria may also be treated by topical or systemic antimicrobials such as topical or oral erythromycin in erythrasma[10]. However, in the current climate of antimicrobial resistance, antibiotic use should be judicious and based on local surveillance data.

Based on several case study reports, silver-containing moisture-wicking textile would also appear to have a role in treating complicated intertrigo. A case series involving two long-term care centres in the US demonstrated relief of symptoms within a five-day period in patients with refractory intertrigo[58,60]. More recently case reports from European centres have claimed resolution of intertrigo after using a moisture wicking textile[62] .

There is some evidence that selected patients with recurrent intertrigo may benefit from surgical intervention, such as women with macromastia,[8,63,64] with Nguyen et al.[65] reporting a long-term improvement in intertrigo following breast reduction surgery of 88.6%. Previously obese patients who have lost significant amounts of body weight (post-bariatric) represent a new and growing group who may benefit from body contouring surgery to remove the excess skin that they are usually left with, which often increases the risk of intertrigo developing. Various surgical techniques are available, such as abdominoplasty, brachioplasty and medial thigh lift. While direct evidence for the most effective surgical approach is lacking, a systematic review by Toma et al.[66] showed that body contouring surgery had a significant positive effect on overall QoL.

Conclusion and recommendations for practice

Intertrigo remains a common condition seen in many practice areas. However, accurate estimates of the true burden of disease are difficult to obtain due to variations in terminology and lack of standardisation and clarity in the reporting of incidence and prevalence rates. The incorporation of intertrigo in the ICD-11 provides a clear case definition and should improve the accuracy of estimates. Indeed, a very recent secondary analysis of a large data set provides a clearer picture of the prevalence of intertrigo in Europe[31]. With regards to the diagnosis, prevention and management of intertrigo in adults, the literature demonstrates consensus among health professionals in approach and this forms the basis for the recommendations of this review (Table 2).

The overall quality of evidence and the strength of any recommendations is low. There remains the need for well-designed studies to test many of these interventions and build a robust evidence-base. This is particularly true for the moisture-wicking textiles, which may have health economic benefits by saving nursing time and facilitating the ability of patients to self-care.

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Figures and tables:

Figure 1: Moisture- Associated Skin Damage.

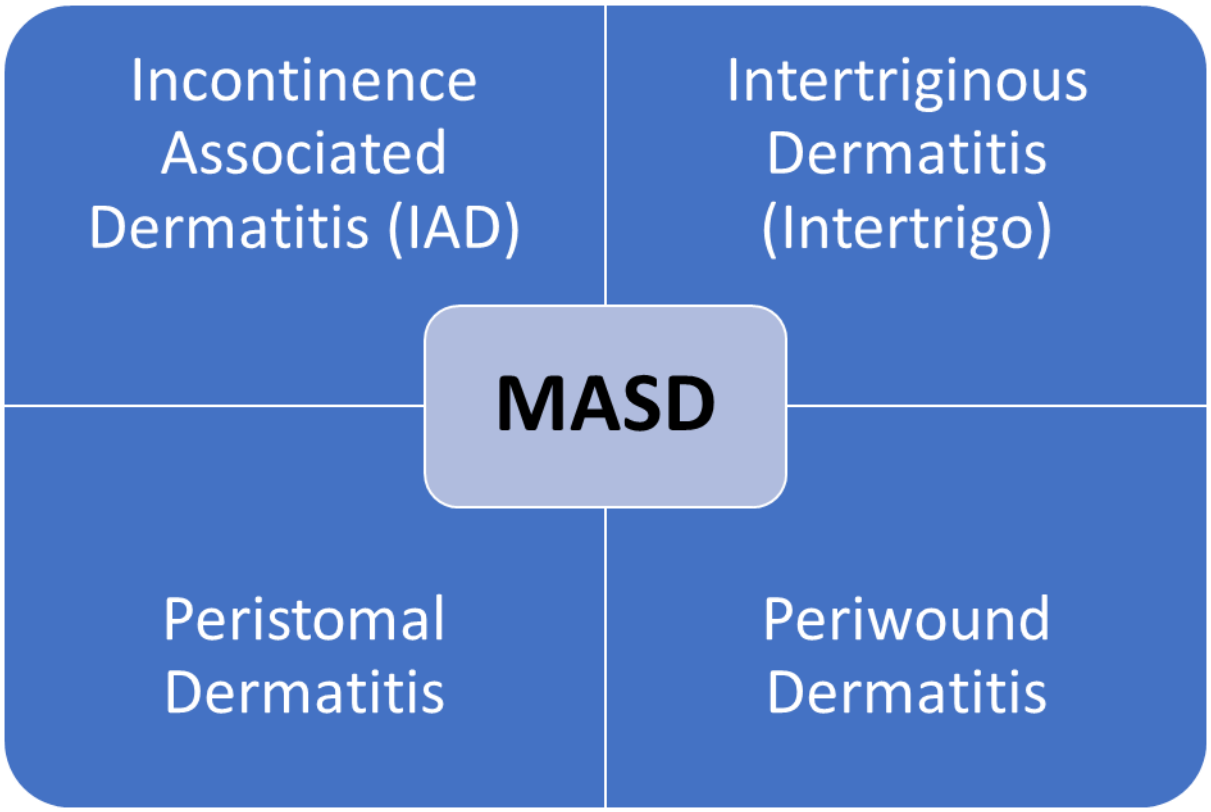

Fig 2. PRISMA flow diagram of literature search

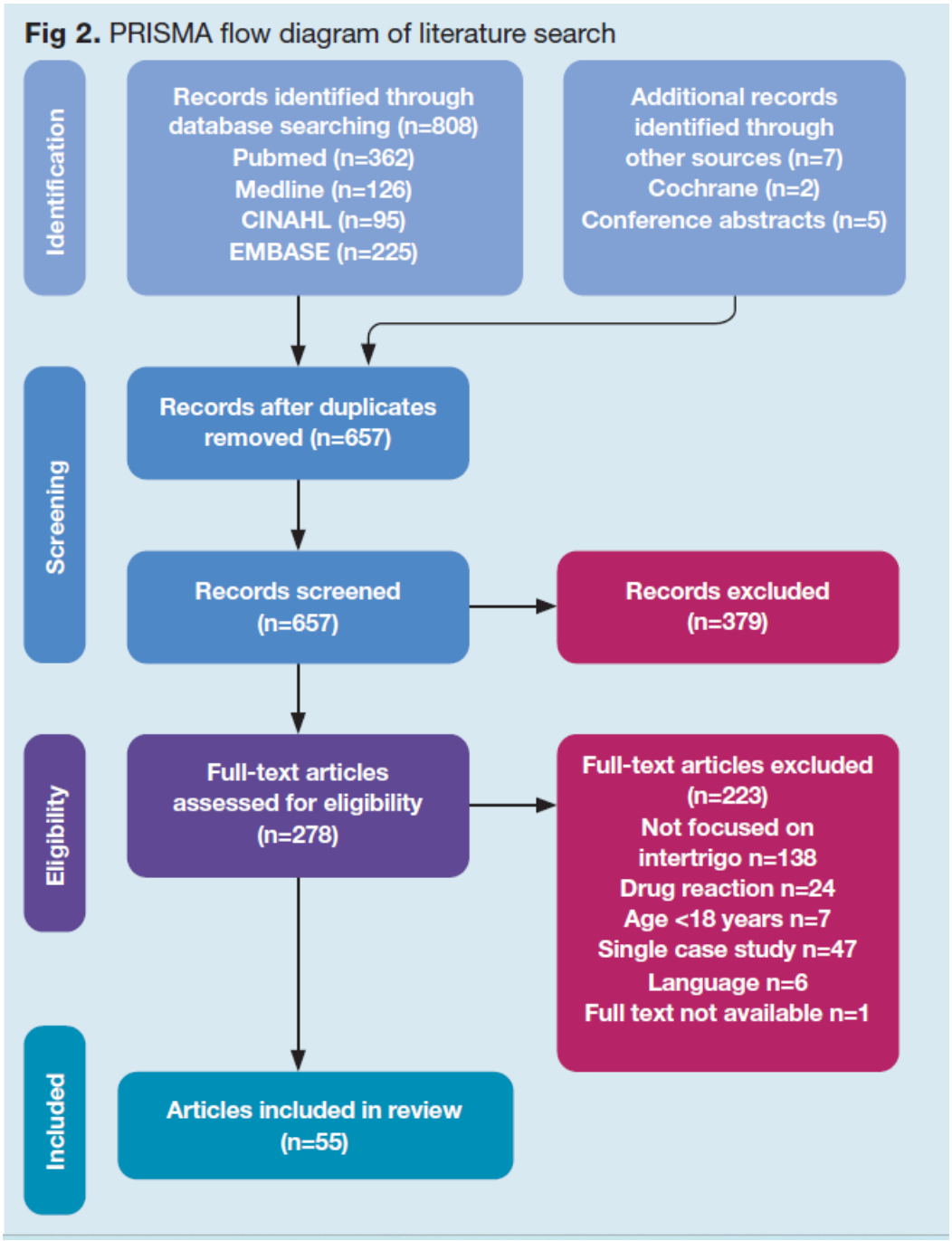

Figure 3: Common sites of ITD

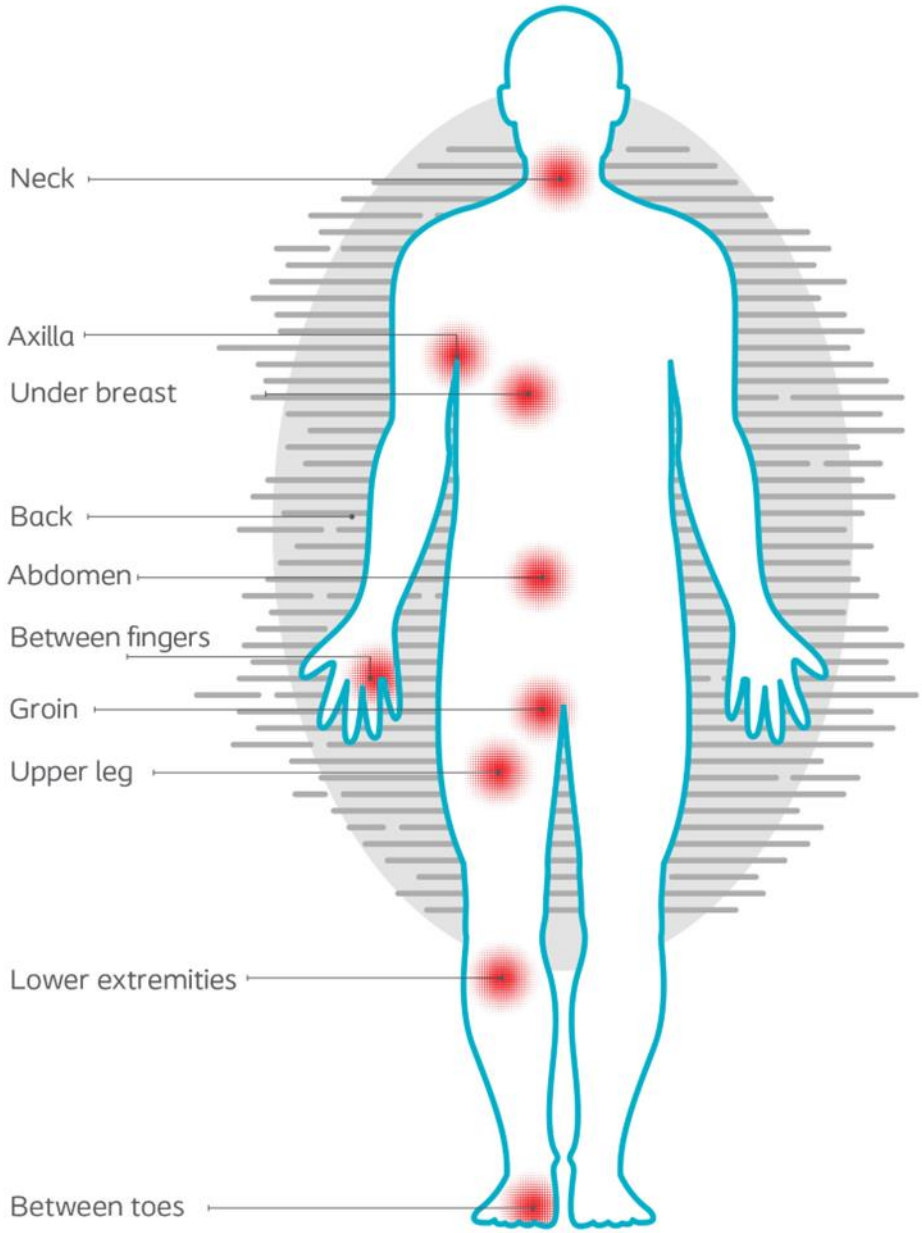

Fig 4. Intertrigo due to allergic contact dermatitis

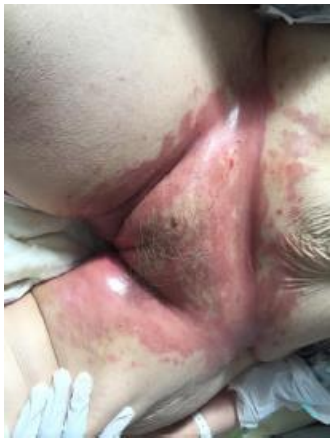

Fig 5. Severe inflammation with erosion, oozing, exudation and maceration

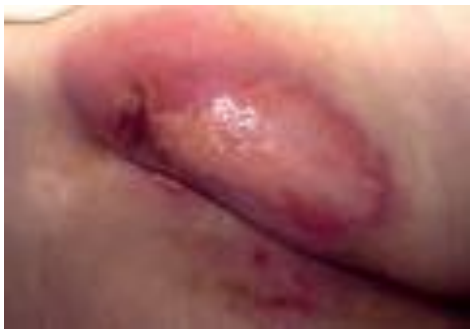

Fig 6. Candidal intertrigo with sharp margins and satellite pustular lesions

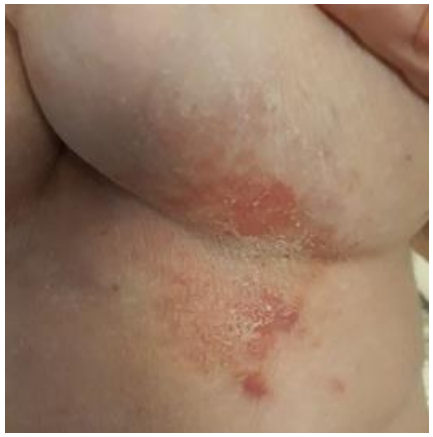

Fig 7. Erythrasma, inguinal, large brownish well-defined, fine scaling patches

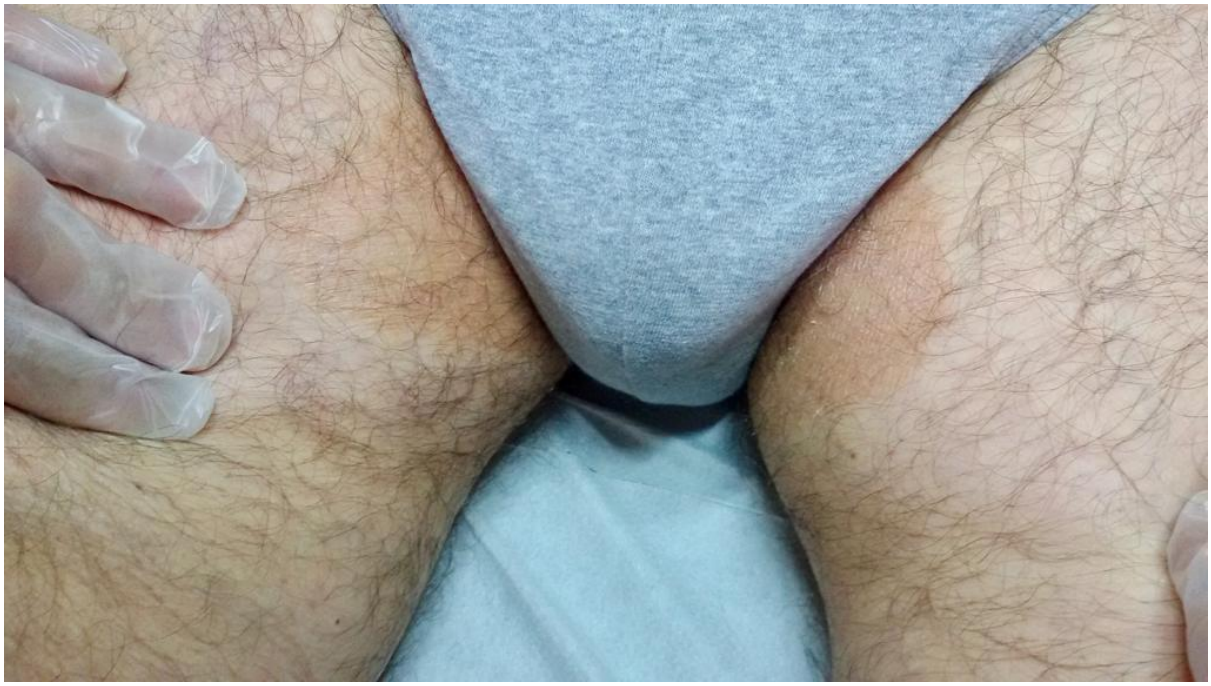

Fig 8. Inverse psoriasis: well-defined erythematous plaques with shiny/ glazed appearance

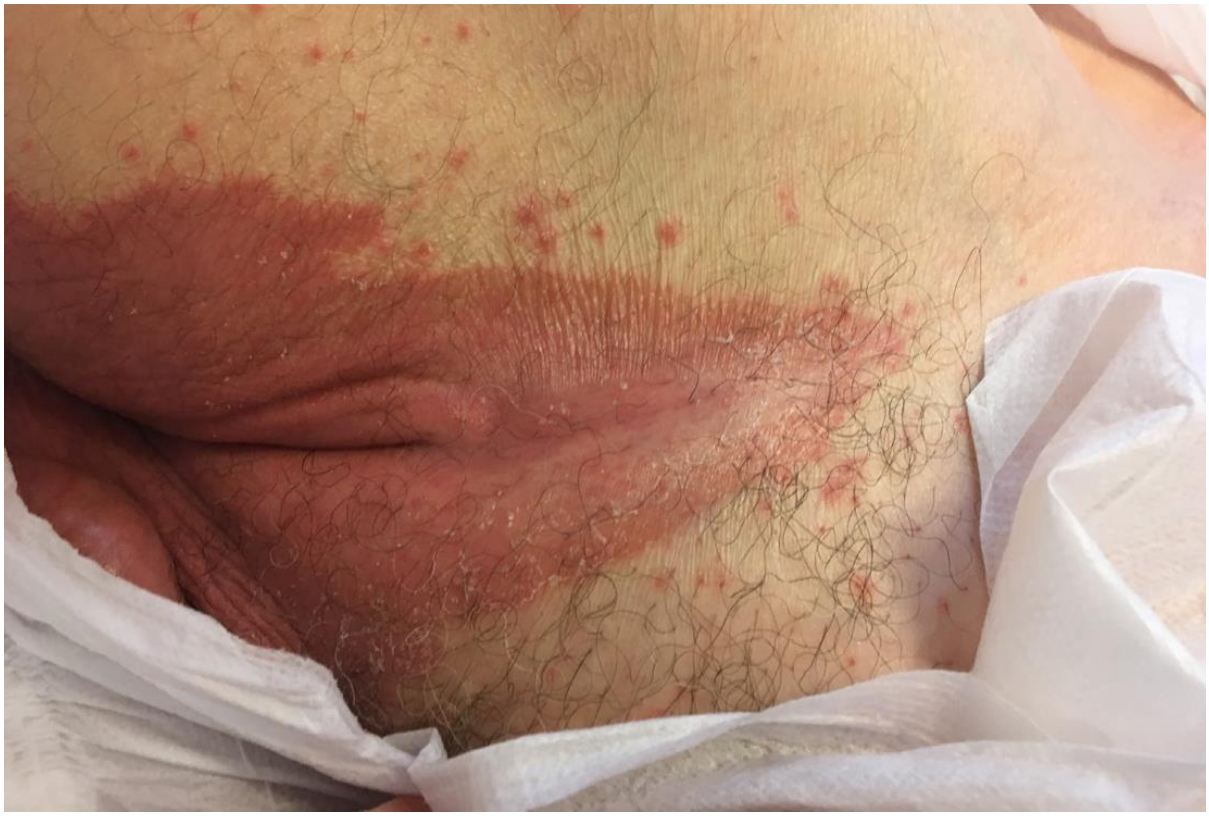

Table 1. Summary of differential diagnoses for intertrigo

Disease	Characteristics	Treatment
Inverse psoriasis (Fig 8)	Involves intertriginous areas such as axillae, perianal, intergluteal, inframammary, genital/inguinal and retroauricular folds. Well-defined erythematous plaques with shiny/glazed appearance and less scaly than plaque psoriasis. Trigger factors are heat, trauma and previous infections. Histology generally shows spongiosis and decreased hyperplasia compared with plaque psoriasis.	Low-potency topical steroids are the first line treatments. Secondary treatments include topical immunomodulators, calcitriol and calcipotriene. These treatments reduce steroid-induced adverse effects. Treatments of resistant forms include systemic agents such as anti-TNFα and anti-IL12/IL23 therapy and excimer laser therapy.[45]
Hailey–Hailey disease (familial benign chronic pemphigus)	Rare autosomal dominant genodermatosis. Characterised by vesicles, erosions, plaques, fissures, scale and crust. Lesions symmetrically localised in intertriginous areas, such as axillae, groin, neck, inframammary folds, perineum and more rarely vulva and mucosa. Typical debilitating symptoms are itching and pain. The chronic recurrent lesions are often resistant to standard treatments and they are exacerbated by sweat, heat, friction and trauma. Histology shows acantholysis of keratinocytes.	The first-line treatments are topical steroids and topical antimicrobials. Oral antibiotics, excisional procedures and botulinum toxin are indicated in refractory disease. Multiple therapies are poorly effective and are associated with important side effects. Low-dose naltrexone is a recent therapy which has shown clinical resolution of symptoms.[46]
Darier disease (Darier–White disease)	Autosomal dominant disorder. *ATP2A2* (SERCA2) gene mutation induces skin, mucous membrane and nail manifestations. Clinical features are yellow or brown keratotic papules and plaques. The lesions involve the seborrheic areas of the face and chest. Palmoplantar pits and nail alteration can be associated. The typical trigger factors are trauma, heat, humidity, ultraviolet B, and infections. Histopathology is characterised by acantholysis, abnormal keratinisation, eosinophilic dyskeratotic cells in the spinous layer (corps ronds) and grains in the stratum corneum.	Corticosteroids and retinoids are typical treatments. These therapies are often unsatisfactory, and they achieve only partial relief. Low-dose naltrexone is effective in mild-to-moderate forms of disease, but it is ineffective in severe cases.[47]
Hidradenitis suppurativa	Chronic inflammatory disease of the terminal follicular epithelium in the apocrine gland-bearing skin. Inflammation, secondary hyperkeratosis and follicular occlusion are involved in the pathogenesis. Characterised by	Antibiotic therapies, retinoids are indicated for mild forms. Immunosuppressive treatments, biologics (anti-TNFα), and surgery are

	relapsing nodules, abscesses, fistulas, sinus tracts, and scarring in the axillae or anogenital region. The diagnosis is clinical and there are several clinical scales to assess the severity of the disease.	approved for moderate-to-severe forms.[48]
Extramammary Paget's disease	Adenocarcinoma developing in apocrine gland areas. The typical location is the vulva, followed by the perianal region, other genital areas and axillae. The disease appears as itchy well-defined desquamative erythematous plaques. Excoriations and lichenification can develop due to scratching. Histologically large atypical cells with bright cytoplasm confirms the diagnosis. This disease can be associated with gynaecologic and solid cancers.	Surgical excision and micrographic surgery are the primary therapies.[49]
Cutaneous drug reaction	Typically, baboon syndrome (BS) or SDRIFE (symmetrical drug-related intertriginous and flexural exanthema). Drug-related symmetric asymptomatic dermatitis with bright-red, well-demarcated lesions. Involves buttocks, intertriginous and flexor areas. Beta-lactam antibiotics, especially amoxicillin, but also non-beta-lactam antibiotics such as pristinamycin can induce this form of cutaneous drug reaction.[50]	
Toxic erythema of chemotherapy (TEC)	Chemotherapy-induced painful erythema and oedema involving hands, feet and intertriginous areas.[51]	
Lichen sclerosus (LS)	Chronic inflammatory autoimmune disease more common among women. Genetic susceptibility, infections, hormones and trauma implicated in the pathogenesis. Characterised by well-demarcated, hypopigmented, atrophic and sclerotic plaques. Occurs in anogenital area and axillae. The diagnosis is clinical and histological. The histology is characterised by epidermal atrophy and dermal lymphocytic infiltrate. Malignant evolution is possible.	First-line: high potency topical steroids (e.g. clobetasol propionate). Second line: topical calcineurin inhibitors and imiquimod cream.[52]
Langerhans cell histiocytosis (LHCH)	Rare disorder that occurs with accumulation of marrow-derived monocytes in the skin and other organs. More common in children. In adults there is frequent systemic involvement and intertriginous skin localisation. Pathologic histiocytes in clusters and sheets and epidermotropism are histological findings that confirm the diagnosis.	Topical corticosteroids, topical nitrogen mustard, oral methotrexate and radiation therapy are effective in diseases limited to the skin. Vinblastine and a corticosteroid cell transplantation, BRAF inhibition, MEK inhibitors are

		used in advanced systemic disease.[53]
Erythrasma (Fig 7)	Common infection caused by the gram-positive bacterium *Corynebacterium minutissimum*. Occurs more frequently in males. Presents as large brownish well-defined, fine scaling patches (cigarette paper appearance) in intertriginous areas. Wood's light exam produces a diagnostic coral red fluorescence due to presence of coproporphyrin III.	Mild forms respond to topical fusidic acid, clindamycin or erythromycin. Extensive erythrasma requires oral antibiotics.[54]
Contact dermatitis	Contact dermatitis located to the skin folds can be induced by various allergens, including aluminium, fragrance, propylene glycol, parabens, vitamin E and lanolin, found in cosmetics, especially deodorants.[55]	The diagnosis of allergic contact dermatitis is confirmed by patch test. The preventions include use of deodorant free of detected allergens and reduction of occlusion in the area. Contact dermatitis responds to local corticosteroids, antihistamines and mild detergents.

BRAF—v-raf murine sarcoma viral oncogene homologue B1; IL—interleukin; MEK—mitogen-activated extracellular signal-regulated kinase; TNF-tumour necrosis factor

Table 2. Recommendations for the management of intertrigo

Recommendation	Evidence rating (SORT)
Identify predisposing factors and educate patient in reducing these (i.e., wearing of appropriate clothing, supportive garments, weight loss)[57]	C
Educate patients in skin fold management and adopt a structured skin care routine, incorporating gentle cleansing with a pH-balanced, no-rinse cleanser and barrier products.[67,68]	C
Treat secondary infection with appropriate topical antifungal agent[2,58]	C
Consider using moisture-wicking textile within skin folds to reduce skin-on-skin friction, wick moisture out of skin folds and reduce secondary infection.[58]	C
SORT—Strength of Recommendation Taxonomy	