

CONTACT DERMATITIS

Maintaining healthy skin in infancy using prevention of irritant napkin dermatitis as a model

Irritant napkin dermatitis is a form of contact dermatitis that occurs in the nappy area as a consequence of the disruption of skin barrier integrity by prolonged contact with faeces and urine. It is a condition that still occurs regularly in young children, and is best managed by prevention. In this update, we will consider the reasons that irritant napkin dermatitis develops, and the simple methods that parents can adopt to avert it. These methods are equally appropriate for general skin care in babies, with the aim of preventing atopic dermatitis, another exceedingly common skin problem in this age group

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What is irritant napkin dermatitis?

Irritant napkin dermatitis (IND) is a common form of irritant contact dermatitis, which takes the form of an uncomfortable rash in the napkin area. IND is diagnosed in approximately one in four babies at some time.^{1,2}

In its mildest manifestation, it is characterised by reddening of the skin, but it can, if inadequately treated, quickly progress to painful exudative or ulcerated lesions. Onset is not usually immediately after birth, but generally from three weeks after birth until two years of age, with peak prevalence between nine and 12 months.^{3,4} It is a common condition in infants, with up to 50 per cent of children affected at least once many experiencing recurrences.⁴

The development of IND may be associated with a change in diet (such as switching from breast milk to bottle milk, or from milk to solids) and with teething.⁵ Antibiotic therapy can also provoke IND, and increases the risk of complicating *candida* secondary infection.⁶ Babies who have had diarrhoea in the previous 48 hours are also particularly at risk, especially those treated with antibiotics.⁴

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What is the skin barrier?

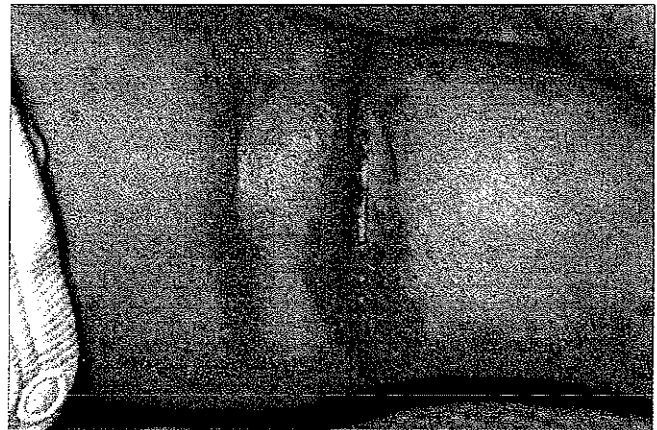
The skin comprises an epithelium known as the *epidermis*, supported by vascular connective tissue known as the *dermis*.

It is now clear that the skin barrier is a function of the outer layer of the epidermis, the *stratum corneum* whose fabrication is the main purpose of the epidermis.⁷

The stratum corneum consists of tightly packed plate-like cells (*corneocytes*) with intercellular lipids. Corneocytes develop by a process of maturation (*cornification*) from the cells called *keratinocytes* which are produced in the innermost (*basal*) layer of the epidermis.

As the keratinocytes move outwards towards the stratum corneum, they differentiate into tough, flat corneocytes. At the end of this period of maturation lipids are extruded from the keratinocytes into the spaces between them (the *intercellular spaces*). These lipids form highly organised liquid structures known as multi-lamellar bilayers, which are essential for the maintenance of the physical integrity and barrier function of the stratum corneum.

The healthy stratum corneum is elastic and pliable; its foremost function is to minimise water loss and prevent the penetration of toxic substances and of micro-organisms. Therefore, the principal functional effects of damage to the stratum corneum will be, firstly, an increase in the outward permeation



Close up of atopic eczema in bend of child's leg

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of water known as *trans-epidermal water loss* (TEWL), and secondly, an increase in the inward permeation of a wide variety of potentially harmful molecules and microbes.

What causes IND?

IND is a direct consequence of a breakdown in the integrity of the skin barrier, resulting in contact between irritants and the living cells of the epidermis.

The breakdown of the stratum corneum is the end result of the interaction of several factors, of which the most important is prolonged contact between skin and a mixture of urine and faeces.

The wearing of nappies causes a significant increase in wetness of the skin. Prolonged wetness leads to maceration (softening) of the

stratum corneum, resulting in disruption of the intercellular lipid lamellae which are so important to its barrier function. This type of damage weakens the physical integrity of the stratum corneum and increases its susceptibility to further damage, firstly by friction from the surface of the nappy, and, secondly by external irritants.

The main external irritants in infants wearing nappies are digestive enzymes present in faeces, mainly faecal proteases and lipases.⁸ Faecal lipase and protease content is greatly increased by acceleration of gastro-intestinal transit. This is the reason for the high incidence of IND observed in babies who have had diarrhoea in the previous 48 hours.⁴

The activity of these enzymes depends to a great extent on pH.

The higher the pH the more active they are. It is the mixing of urine and faeces that causes the pH to rise and the enzymes to become more active.⁸ The reason for this is that urine contains a great deal of urea, and faeces contain an enzyme called urease, which breaks down urea and causes an increase in pH.

The urease in faeces largely comes from colonic bacteria.⁹ It is relevant to note that cow's milk formula-fed infants support larger numbers of urea-producing types of colonic bacteria, which might offer an explanation for the observation that they have higher faecal pH and also appear to be at greater risk of IND.

It has also been found that a low skin surface pH is essential for the maintenance of the normal microflora. One of the most important benefits of this normal microflora is that it provides innate anti-microbial protection against invasion by pathogenic bacteria and yeasts.¹¹ Thus, an increase in skin pH not only leads to a great increase in irritancy of faecal digestive enzymes but also increases the risk of bacterial and yeast infection. Despite this, bacteria and yeasts do not appear to have a substantial role in most cases of IND, though they may on occasions complicate it.

Skin care of the napkin area

It is logical that skin care routines are likely to be of value in preventing IND, and that the same routines will also help to prevent other forms of irritant dermatitis in infants, particularly atopic dermatitis. In practice there are very few controlled trial data to support any particular practice; therefore the principles guiding good practice must be based mainly on basic rational principles.

There is an increasing recognition that avoidance of soaps and detergents, gentle cleansing, good nappy practice and regular application of a protective barrier are all essential elements in care of the skin in the napkin area and therefore likely to have value in the prevention of IND.¹¹⁻¹³

• skin cleansing

It is clearly essential for the prevention of IND that faeces should be removed from the skin as soon as possible after the nappy has been soiled.

Avoidance of soaps and detergents
Soap and all types of detergents (commonly present in branded baby-washing products) will

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remove lipids essential for normal barrier function, and should therefore be avoided in all infants. *Cleansing using emollients and/or water*

Infants should probably be bathed once daily. It appears to be best to use a water-dispersible cream in place of soap during the bath, massaging it into already wet skin before rinsing it off. Preparations for this purpose include Cetraben, Dermol and Diprobace creams.

Ideally, following defecation at home, the baby's napkin area should be washed in a basin or bidet containing warm water, using a water-dispersible cream as for the bath. However, time does not always allow this, and when out of the home, an alternative is required. A logical option is to use water. The best of the modern baby wipes are ideal for this purpose. High-quality wipes do not contain detergent or alcohol, and have the great advantage over cotton-wool balls, for example, of using extremely soft fabric to minimise friction.

• choice of nappy

Good quality super-absorbent disposable nappies should be preferred. Compared with washable cloth nappies, these have been shown to be associated with a reduced incidence and decreased severity of IND.¹⁴ The benefit of super-absorbent disposable nappies is likely to be a consequence of urine being quickly absorbed into the nappy core, away from the skin, reducing both wetting of the skin and mixing of urine with faeces.

One of the potential problems with this type of nappy is that it can be difficult to detect either when it is saturated with urine or when it contains faeces. Parents therefore need to be vigilant, particularly in noticing when their baby defecates. The nappy should be changed as soon as possible after defecation and at reasonably frequent intervals in any case, depending on the age of the baby

(and therefore the volume of urine passed at micturition).

• emollient and barrier formulations

The practice of applying barrier preparations in the nappy area is a well established one, with the aim of reducing friction, wetting and contact with urine and faeces.

In the UK, pastes have been a popular class of formulation for IND, containing finely powdered material such as zinc oxide or titanium dioxide suspended in a variety of vehicles. The use of these pastes was originally based on a belief that they were able to dry weeping skin lesions. However their ability to do so is limited, and is in any case no longer seen as desirable.¹⁵ Neither do their barrier properties appear to be superior to other products.

In general, water-in-oil formulations, with a lipid content $\geq 50\%$, provide a superior moisture barrier than lighter oil-in-water products.¹⁶ For this reason, ointments are generally more effective than creams and lotions.¹⁷

When considering what would constitute the ideal everyday barrier preparation, one needs to consider the relevance, tolerability and safety of constituents other than the lipids alone. Every ingredient should have a rationale for its inclusion; none should have known toxicity or lack a documented safety record.

Healthcare professionals have indicated unease over the widespread use of manufactured baby skincare products which are promoted as especially suitable for babies' skin, but which in actual fact include ingredients that are potentially harmful.¹⁸ For this reason, non-essential ingredients such as perfumes should be omitted since they may cause allergic contact sensitisation.¹⁹

Preservative should be avoided. The greater the lipid content, the less likely a preservative will be required; thus, preservative is always required in creams and

lotions, but not in ointments.

Talcum powder offers no protection to the skin since it does not form a continuous lipid barrier layer over the skin. It is also extremely abrasive, and its routine use in the care of infants' skin may be hazardous.²⁰

White soft paraffin BP is regularly used by healthcare professionals to protect the skin. It is, however, exceptionally occlusive when compared with other emollients and is not therefore ideal for continuous use,²¹ since complete occlusion can prevent the recovery of damaged stratum corneum.²²

However, the regular use of white soft paraffin on babies' skin for the prevention of IND has never been evaluated.

Clinical trial data on barrier emollients for infants are very limited. In one study, it was demonstrated that skin quality in premature infants (who demonstrate increased TEWL compared with full-term babies) was improved by application of ointment. The adoption of a skincare regimen that featured increased emollient use was also shown to improve skin condition in full term neonates.¹²

Two placebo-controlled trials have shown good evidence of benefit in the prevention and treatment of IND for Bepanthen ointment.¹³

A number of disposable super-absorbent nappies now have emollient applied to the fabric that comes into contact with the baby's skin. This is a valuable feature, but does not reduce the benefit of separate use of appropriate barrier emollients in the napkin area.

Care of the nappy area is a good model for general skin care in infants

The skin disease known as atopic dermatitis (or atopic eczema) now affects at least 15 per cent of all children at some time, most commonly starting in infancy.

clinical update

Current research suggests that this condition is principally a response of the skin to assault by irritants, of which the most potent is the drying effect of air. Anything that compromises function of the skin barrier will increase its susceptibility to the harmful drying effect of air, and it is likely that the worst offenders in this respect are baby-washing products. Indeed, evidence is accumulating that the rapid increase in prevalence of atopic dermatitis in infants is due to the parallel increase in use of such products.

Atopic dermatitis and IND are both forms of irritant dermatitis differing only in the nature of the principal irritants responsible. Maximum support of the skin barrier is a key measure in the prevention of both and the methods are essentially the same:

- appropriate skin cleansing technique
- regular application of protective emollient
- avoidance of skin contact with irritants

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STUDY DAY

CPD 5hrs

DISTRICT NURSING IN A MODERN NHS LIBERATING THE TALENTS

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HARROGATE

ISSUES

- Developing capacity and skill sets in the district nursing services
- Defining and meeting education and training needs
- Ensuring appropriate professional development opportunities
- Efficient management structures to support effective practice
- Pre-empting unnecessary admissions
- Implications of the new GMS Contract
- Meeting modernisation imperatives
- The Evercare Project and its potential benefits

This study day will showcase developments helping to liberate the talents of district nurses to work effectively and in partnership with general practitioners and practice nurse colleagues.

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