Clinical Guideline: Maintenance of skin integrity

Original Author: East of England benchmarking group members

For use in: Eastern Perinatal Network Units
Guidance specific to the care of neonatal patients

Used by: Healthcare professionals giving direct care to neonatal patients

Key Words: Assessment, skin, card care, bathing, humidity, integrity

Date of Ratification: January 2011

Review due: January 2014 (or earlier in the light of new evidence)

Registration No: EOENBG-02

Version: 1

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Audit Standards:
1. A validated skin assessment tool is in use
2. Staff, parents and carers are educated on aspects of skin integrity
3. Staff implement measures to maintain skin integrity specific to pre term infants (<30 weeks)
4. Appropriate measures are taken to promote maintenance of skin integrity as outlined in the guideline and benchmarking documents
5. Maintenance of Skin Integrity

1. Scope
For use in neonatal units participating in the East of England

2. Purpose
- To promote skin integrity
- To protect the skin’s immature barrier function
- To reduce trauma to the skin

3. Background
Maintaining skin integrity is an important aspect of neonatal care as newborn infants are adapting from an aquatic environment to one where they are exposed to air. Throughout this adaptation process the skin assists in thermoregulation, is a barrier against toxins and infections, permits water and electrolyte excretion, stores fat and permits tactile sensation and communication. When an infant is born at 23-24 weeks gestation the skin is very fragile due to an underdeveloped stratum corneum providing no barrier function and the skin itself provides 13% of the body weight compared to 3% in an adult so any trauma will have a greater significance. Large volumes of water can be lost through the immature skin leading to hypernatraemia and dehydration and the barrier function of can lead to absorption of chemical and drugs.

During care the skin of the newborn is at risk for disruption of its normal barrier function by trauma caused by a variety of actions and substances that the skin is exposed to.

4. Causes of skin breakdown
- Gestational age <32 weeks
- Pressure – oedema, use of paralytics/sedatives
- Use of inotropes
- Adhesive use – ET tube fixation, IV securing
- Surgical wounds and ostomies
- Birth injury
- Skin disease – epidermolysis bullosa
- Infection
- Friction
- Burns
- Nappy rash
- Trauma/iatrogenic injury

5. Prevention of skin damage

5.1 Assessment
Skin assessment is part of the provision of care and allows the healthcare professional to recognise where potential problems arise and warns of the need to initiate prompt treatment.
A Newborn Skin Assessment Tool designed to evaluate the skin condition in all infants from term down to very-low-birth-weight should be used. Assessment should include depth of dryness, erythema, hydration, discoloration and breakdown/ necrosis and be used in conjunction with skin care guidelines to show the overall improvement in skin condition when the guidelines were applied. A daily assessment is recommended or there is documentation to say why it has not been completed.

5.2 Handling
All handling episodes should be made as gentle as possible. Prevent trauma by not wearing any jewellery on the hands or having false or long fingernails. Hand washing is a priority as well as use of alcohol hand rub prior to handling ensuring that the alcohol has dried. All healthcare professionals should be bare to elbow.

5.3 Positioning aids and bedding
Preterm infants have poor muscle tone and disorganised movements, which are energy consumptive. If placed on a flat surface without support they will assume a flattened position, which may interfere with development. Therefore positioning aids are used to encourage the infant to adopt a flexed, tucked posture.

These aids should be soft to allow the infant to lie in one position for a few hours without causing any pressure. Also any bedding, hats and clothing should be soft, non-scratchy and not stretched as with a hat that is tight might put pressure on not only the skin surface but also the underlying blood flow.

Consideration should be given to the detergents used to wash these products as they may cause an increase of the skin pH, which irritates the physiological protective 'acid mantle' and changes the composition of the cutaneous bacterial flora.

5.4 Humidity
Preterm infants may lose up to 13% of their body weight as transepidermal water loss (TEWL) in the first day of life when nursed in 50% humidity - these losses may still be significant at 4 weeks of age. Limiting the TEWL by use of humidity will allow serum sodium levels to be maintained at normal levels without increasing the fluid load which has been shown to lead to potential complications. (See separate EoE Benchmarking Humidity Guideline).

5.5 Use of adhesives
Adhesives should be used sparingly to secure life support, monitoring and other devices. The diminished cohesion between the epidermis and dermis, means that when tape is removed it remains adherent to the epidermis and this can cause stripping. The use of a pectin based barrier decreases the amount of epidermal stripping in preterm infants. ECG electrodes and temperature probe covers should have hydrogel adhesive to prevent stripping of the skin on removal.

Peripheral intravenous cannulae should be secured using a clear semi-permeable membrane e.g. IV3000 to permit close observation of the cannula and prevent stripping on removal. A skin protectant can also be used to care for very fragile skin e.g. Cavilon, before applying the dressing in very preterm infants.
Where adhesives have been used great care is required to remove them gently by using warm water and gauze/cotton wool to gradually loosen the tape prior to peeling gradually back. This technique can also be employed when removing the electrode gel from EEG leads. Solvents should not be used to remove any adhesive as they contain hydrocarbon derivatives or petroleum distillates that are potentially toxic\(^{15}\).

### 6. Pressure and Friction Injuries

There may be injuries caused by friction to the elbows and knees especially in the preterm infant, which can be reduced by nursing infants on soft sheeting and nesting that has been washed in a detergent with a pH close to the skin’s acid mantle and help reduce the development of dry skin\(^{16}\). The skin pH of full-term infants has an alkaline pH of 6.34 but within 4 days this has fallen to 4.95. Preterm infant pH on day of birth is >6 but decreases by week one of life to 5.5 and decreases to 5 by week three\(^{17}\).

Pressure injuries are not often seen in the neonate due to the large surface area to weight ratio but there are certain areas that are more at risk such as the lobes of the ears due to too tight headgear or the head not re-positioned frequently due to severity of illness.

There may be pressure on the nares from nasal intubation or biprong CPAP. Where CPAP is used the prongs should be taken out at **every** care session to be inspected to ensure patency and also to relieve any pressure and change the position. Consideration should be given to oral ET tubes, which are used for a long period of time as this may cause palatal grooving, so the position should be checked with each care.

If an infant is side lying or prone there may be pressure on the nasogastric tube pressing against the cheek so it is important to ensure that the infant's position is changed regularly and that the end of the tubing is not under the infant.

Monitoring equipment can lead to pressure necrosis; especially where the infant is very preterm as the dermis is oedematous and this reduces blood flow to the epidermis and makes the skin more susceptible to breakdown therefore it is important to ensure regular re-siting of probes and repositioning of the infant.

If an infant is so sick that paralysis and sedation are required it is important to instigate preventative measures such as air mattresses, passive limb physiotherapy, flexed supported positioning and close observation of dependent areas. If an infant is hypotensive this can lead to peripheral tissue hypo-perfusion, which is another risk for skin breakdown from pressure on dependent parts.

### 7. Products used on the skin

Care should be taken with any product used topically as there may be absorption through the skin of drugs and chemicals\(^4\). Absorption takes place by intracellular route by passive diffusion and is rapidly absorbed from the capillary rich dermis.

- Avoid agents with perfumes and dyes
Apply sparingly to the smallest area possible
Use of alcohol swabs should be limited
Remove antiseptic cleansing agents as soon as possible with warm sterile water
Do not apply occlusive barrier over antiseptic solutions

Aqueous based disinfectant rather than alcohol-based products should be used to minimise trans-dermal alcohol absorption and chemical damage.
Where oils are used on the skin to treat or prevent dry cracked skin these should be preservative free and able to be mixed with water. They should be dispensed in small aliquots in sterile containers and allocated as ‘one patient only’ use.

Oil is used for the baby massage to ensure that the strokes on the baby’s skin are smooth and do not cause any friction. Massaging without oil can be irritating, especially for a sensitive newborn. For vulnerable infants who have unique skin problems and may have a poorly functioning immune system, it is safer to use a highly purified/refined oil.

The oil should contain a high percentage of Linoleic Acid which is found in Refined Sunflower Oil. This should be made up in 50ml clear bottles with a ‘flip’ cap for ease of use, stored in a cool dry place. It should be for ‘one patient use’ only and clearly labelled with an addressograph.

Parents should be advised that cleansing agents should not be added to a baby’s bath water nor should lotions or medicated wipes be used.

8. Nutrition
The infants overall nutrition should include adequate fluid, calories and amino acids, carbohydrates and fats as well and trace minerals and vitamins that are essential components for maintaining an intact and healthy skin. Preterm infants have decreased fat stores, which can lead to scaling of the skin with irritation in the groin and neck. It can also lead to impaired clotting, as essential fatty acids are necessary to promote platelet function.
Zinc is needed for normal wound healing and infants may lose zinc via stools or urine, have low or absent stores or increased demand due to rapid growth, stress or extensive tissue healing. Loss of zinc is indicated by red, scaly skin with excoriations in the groin and neck folds.

8.1 Intravenous solutions
Where peripheral intravenous lines are used the concentration of any dextrose solution should be limited to 12.5% as hypertonic or acidic electrolyte solutions will lead to tissue damage if infiltrated. If higher concentrations are required the fluid should be infused via a central line. Hourly assessments using a tool (e.g. NPIP scores) can prevent or minimise the risk of infiltration. Where inotropes are used peripherally there should be close observation of the site proximal to the cannula (for management of extravasation injuries see guideline).
9. **Surgical wounds and stomas**

Because the normal barrier to infection function of the skin is underdeveloped in the newborn when the skin is opened surgically the risks of infection become much higher. Also the normal host defence mechanisms are not completely developed and antibody levels are not high enough in preterm infants to mount an adequate response to invasive sepsis. The risks are greater if the wound is large or the duration of the surgery is long, preoperative stay of more than five days, previous systemic infection or if there is contamination at operation but gestational age and birth weight has no influence\(^{21,23}\). Post operatively wounds can be left exposed or a skin protectant may be used to cover the wound according to the surgeon's instructions. Advice should be sought from specialist tissue viability and would care nurses as available.

Ostomies are often created in cases where there has been NEC usually involving a proximal or functioning stoma and a mucous fistula to allow for decompression of the distal bowel. The skin must be protected from effluent, which can be damaging because of its enzyme content, pH level and liquid content. The skin must also be protected from damage done by the adhesives used to stick the ostomy bags to the skin. Warm water and gauze should be used to loosen the barrier adhesive. The area around the stoma should be cleaned with water between bag applications and soap should not be used. Once dried, the area can be protected with a skin protectant e.g. Cavilon. A pouch and pectin-based barrier that fits the infant's abdomen should be selected; the pouch should be clear to allow for inspection of the stoma. The type of appliance will depend on the type of stoma and the faecal matter that it is capturing. Most bags have pectin-based barriers which will bond with the skin and maintain an adequate seal. Stoma size will decrease over time and will need to be re-measured with each appliance change until stabilized. The barrier should fit closely around the stoma to protect the skin, so should be no more that \(\frac{1}{6}\)th of an inch larger than the stoma, so that only \(\frac{1}{16}\)th of an inch of peristomal skin is exposed. Skin barrier pastes should be avoided as they contain alcohol\(^{24}\).

10. **Use of Anti-fungal**

It is important to identify a candida albicans rash and treat appropriately as normal barrier creams will worsen the condition. The typical rash is one of intense inflammation that is bright red and sharply defined in the inguinal folds, buttocks and thighs\(^{25}\). The area should be swabbed to identify the cause and topical treatment with medication commenced. The area can also be exposed to the air and light.

11. **Care of the Nappy Area**

Nappy rash is an irritant contact dermatitis caused by prolonged contact of the skin with urine and faeces, making the skin more prone to disruption through friction with the nappy\(^{26}\). Urine alters the skin pH from acid to alkaline, which makes it more easily colonised with microorganisms. The change in the pH activates the enzymes in the stool to affect the proteins in the stratum corneum, leading to skin breakdown\(^3\). Prevention of nappy rash is the primary goal of nappy area care – but if nappy rash occurs the treatment should aim to reverse the skin damage and prevent recurrence\(^{27}\). Nappy rash does not occur in underdeveloped countries where nappies are not worn\(^{28}\).
11.1 Predisposing factors for nappy area breakdown
- Broad spectrum antibiotic therapy
- Immaturity/maturity of skin
- Infants with substance withdrawal
- Jaundice
- Post abdominal surgery e.g. short gut syndrome

11.2 Assessment
Assessment of the nappy area should take place at every nappy change. The frequency of the nappy change will be dictated by the infants’ condition. Close observation of the infant during the nappy changing procedure as it can induce changes to heart rate and SpO₂ and the angle that the buttocks are lifted to should not exceed 30 degrees as this can lead to cardiac decelerations²⁹

11.3 Prevention and Treatment
- Avoid prolonged contact with urine and faeces²⁶
- Regular gentle cleansing of the nappy area with warm water
- Avoid the use of soap or lipid solvents for up to 8 weeks in preterm infants as they will remove the lipid from the stratum corneum ³⁰,⁹
- Where possible bathe once daily in water
- Use a barrier cream at the first sign of redness, after cleansing at each nappy change
- Expose the nappy area to air if indicated
- Choose a disposable nappy that has absorbent gelling materials as this prevents skin over-hydration and provide a more beneficial pH in the nappy area³¹
- Treat known causes i.e. candida infection.
- Encourage breast feeding as the stools of breastfed infants are less caustic to infant skin³²

A- Airing
B- Barrier
C- Cleansing
D- Diaper (nappy) selection
E- Education of caregivers³³,³⁴

12. Cord care²²
The amount of cord handling should be kept to a minimum. There is no need to clean with an antiseptic. The nappy should be turned down to expose the cord stump to air as this had been shown to speed up the healing process. The cord clamp may be left on as this may help speed up the process of cord separation due to the increased weight. For more information see EoE Benchmarking Group Guideline for Umbilical Cord Care.

14. Audit
Audit will be through annual benchmarking activity and consequent action planning using infant’s charts and care plans to assess quality outcomes and guideline adherence. Poor scores may necessitate more frequent audits to ensure progress is being made.
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