

Care of Burns in Scotland

National Managed Clinical Network

Paediatric Guideline

Nutrition in Thermal Injuries

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NOTE

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

NUTRITIONAL MANAGEMENT OF PAEDIATRIC BURNS PATIENTS

Aims of Nutritional Support in Burns

- To promote optimal wound healing
- To maintain lean body mass
- To minimise the risk of infection
- To maintain normal growth

Classification of burns

The main causes and types of burn injury include water, contact, flame, fat, chemical or electrical. Burns are classified as a % of surface area. Depth of burn / scald is classified as:

- partial thickness (superficial, superficial dermal, deep dermal)
- full thickness

Who Requires Dietetic Assessment?

Please refer the following patients to the Dietitian:

1. All children with >10% burns
2. All infants with > 5% burns
3. Infants and children with burns/scalds <5% and 10% respectively to whom one or all of the following applies:
 - Burns to face or hands, impacting on oral intake
 - Poor dietary intake for a period of 48 hrs
 - Poor appetite or history of weight loss on admission
4. Any infant or child requiring grafting

If a patient's admission is anticipated to be <48hours, dietetic referrals are not warranted. Dietary intake should be encouraged in these patients and regular meals and snacks offered by ward staff.

On Admission

All children admitted with a burn or scald **must** have the following measured on admission by nursing staff:

- **Weight (if weight is estimated please document this & obtain actual weight as soon as possible)**
- **Length/height**
- **Refer to local weighing and measuring guidelines**

Burns < 10%

Infants:-

- offer usual formula/breast milk. **If burn > 5% refer to dietitian**

Children:-

- Offer nutritious fluids such as milk and milkshakes in preference to water, fizzy drinks
- Encourage frequent meals and snacks

Infants & Children:-

- Document oral intake on fluid balance/food record chart
- Aim to introduce oral intake as soon as possible

Burns > 10% (or 5% in Infants)

- Refer patient to the Dietitian
- An *NG tube for feeding should be passed within 24 hours of admission. Enteral feeding reduces the incidence of paralytic ileus (McCarthy 2007, MacDonald et al 1991)
- Type of feed and regimen will be recommended by the Dietitian
- Where possible oral intake should be encouraged in addition to enteral tube feeding
- If the patient is admitted out with dietetic working hours please refer to Appendix 1 for advice on commencing tube feeding
- If the gut is inaccessible or non-functioning Parenteral Nutrition should be commenced

***If a patient is likely to require frequent periods of fasting (i.e for theatre) or is at high risk of aspiration a naso-jejunal tube should be considered. Patients must be fed continuously via the jejunal route.**

IT IS IMPORTANT TO REMEMBER THAT SOME PATIENTS WITH 5- 10% BURNS MAY REQUIRE ENTERAL TUBE FEEDING DEPENDING ON SITE OF BURN, SURGICAL MANAGEMENT AND PRE-BURN NUTRITIONAL STATUS.

Nutritional Requirements

Nutritional requirements will vary depending on:-

- Age, Sex, Weight and Height (length if < 2years)
- % Burn Surface Area
- Thickness of Burn
- General nutritional status

ENERGY

Energy needs are thought to be increased in burns > 10%

Energy requirements are calculated using the Hildreth (1982, 1989, 1990, 1992) formula as below:-

Infants < 1 year	2100kcal/m² Total Body Surface Area (TBSA) + 1000 kcal/m² Burn Surface Area (BSA)
Children < 12 years	1800kcal/m² (TBSA) + 1200kcal/m² (BSA)
Children > 12 years	1500kcal/m² (TBSA) + 1500kcal/m² (BSA)

Please refer to Appendix 2 for an example of calculating energy requirements using Hildreth Formula.

In the absence of a height/length and weight necessary for calculating Hildreth equations please use EAR for age to calculate energy requirements. EAR tables can be found in Appendix 2

Calculated energy requirements are an estimate only and may fluctuate throughout clinical course. These patients require frequent monitoring of nutritional status, feed tolerance and wound healing and feeding regimens adjusted accordingly.

PROTEIN

It has been shown that appropriate wound healing is achievable in children over 1 year receiving 2 – 3 g protein / kg / day. For children <1 year use RNI protein for age & sex (Cunningham, 1990). These are shown in Appendix 3.

FLUID

Please refer to Fluid Resuscitation Guideline.

VITAMIN & MINERAL REQUIREMENTS

There are currently few studies which support routine vitamin and mineral supplementation in paediatric burn patients, however this is an area of debate (McCarthy & Sully 2007). It is essential that requirements are achieved for vitamins and minerals due to the frequency of micronutrient deficiency after major burns.

Vitamins A, B, C, Iron, Zinc, Copper and Selenium play an important role in the wound healing cascade.

Serum levels should be monitored routinely in patients with >40% TBSA and those with demonstrated poor wound healing.

Patients with burns and scalds should be prescribed enteral vitamins and iron as per Table 3.

Consider routine supplementation of copper, selenium and zinc in TBSA > 40% and those who are showing signs of poor wound healing.

Table 3

Multivitamins -

eg. Dalavit 0.3ml/day (0-12months) OR 0.6ml/d >1 year

eg Sytron

< 1 year	2.5ml bd
1-3 years	2.5ml tds
3-6 years	5.0ml bd
6-12 years	5.0ml bd

It is important that supplementation of any nutrient should be reviewed when used in conjunction with enteral and/or parenteral nutrition. Ideally, this should include appropriate monitoring of biochemical parameters.

Multivitamin supplementation should continue for 1 month post discharge and be discontinued at the Consultant's discretion.

Types of Enteral Formula

Age	Type of Feed
< 1year	<ul style="list-style-type: none"> • Expressed Breast Milk (EBM) • Standard Infant Formula (e.g SMA Gold, C&G Premium) • * Specialist Infant Formula (e.g Pregestimil, Neocate) • ** High Energy Infant Formula (e.g Infatrini, SMA High Energy) • *** Preterm Infant Formula
1-6 years (8-20kg)	<ul style="list-style-type: none"> • 1kcal/ml feed (eg Nutrini Standard) • 1kcal/ml fibre feed (e.g Nutrini Multifibre) • 1.5kcal/ml feed (Nutrini Energy) • 1.5kcal/ml fibre feed (eg. Nutrini Energy Multifibre)
6-12 years (>20kg)	<ul style="list-style-type: none"> • 1kcal/ml feed (e.g Nutrison Standard) • 1 kcal/ml fibre feed (e.g Nutrison Multifibre) • 1.5kcal/ml feed (e.g Nutrison Energy) • 1.5kcal/ml fibre feed (e.g Nutrison Energy Multifibre)

*Specialist infant formula such as hydrolysed, low electrolyte or MCT formula may be required in certain clinical conditions. Please liaise with your dietitian.

** High energy infant formulas may be required if nutritional requirements cannot be met using standard formulas. **Infatrini is not recommended for infants <3kg.**

*** Preterm infant formula can be used in the absence of EBM in infants weighing <2.5kg

In rare cases a semi-elemental formula may be used if clinical signs of malabsorption are present or if significant perineal involvement where reduced stool frequency may aid wound healing.

Nutritional Considerations

Diarrhoea – occurs frequently in paediatric burns patient but appears unrelated to enteral feeding. The use of broad spectrum antibiotics may alter gut flora and increase the incidence of diarrhoea.

Before stopping, slowing or changing enteral feeds a review of the patient's drug therapy should be undertaken and stool samples obtained for culture.

Additional Fluid– if additional fluid is required in excess of feed volume this should be given as enteral water (as flushes or orally if possible) or IV fluids as recommended by medical staff. The volume required should be directed by the medical staff.

Monitoring Nutritional Status

Burn injuries are dynamic as are nutritional needs in this patient group. As the percentage burn surface area changes so will nutritional requirements.

Anthropometry

- Regular weights (without dressings where possible OR noting presence of dressings) should be recorded and plotted on appropriate centile charts.
- Weigh toddlers and children a minimum of weekly

Note: oedema may mask true weight early on in the clinical course

Biochemistry and Haematology

- All patients receiving enteral tube feeding should have their U+E's , calcium, phosphate & magnesium as well as full blood count checked at least once weekly
- Patients receiving parenteral nutrition will require more frequent monitoring of U+E's – refer to local guidelines re: PN monitoring.
- Serum levels of Vitamins A, B, C, Iron, Zinc, Copper & Selenium should be monitored in 'at risk' patients who have demonstrated signs of poor wound healing (interpret with care in presence of inflammatory response)
- Consider routine supplementation of above if > 40% TBSA burns.

Nutritional Requirements

- These will change in accordance with changes in burn surface area and will require regular re-assessment.
- Oral intake, where possible, should be accurately documented

GI Symptoms

- Record the number and consistency of bowel motions
- Record frequency and volume of any vomits

Appendix 1

An Example Enteral Feeding Starter Regimen (use only in the absence of a Dietitian)

Aim to start enteral tube feeding in the first 6 hours of admission

After fluid resuscitation aim to meet full maintenance fluid requirement via infant formula or enteral feed.

Age Range	Type of Feed
If < 1year	Use the formula the infant usually takes eg. SMA Gold, Cow & Gate Premium. If the infant is breast fed use EBM if available
If 1-6 years Wt 8-20kg	Use Standard paediatric formula e.g Nutrini Standard (1kcal/ml)
If > 6 years Wt > 20kg	Use Standard adult formula e.g Nutrison Standard

All feeds should be given at full strength as a continuous feed over 24 hours initially. Start feed at 5-10ml/hr and increase as tolerated e.g every 4 hours.

Oral feeding should be encouraged where possible and overnight feeding may be used to support this.

In patients > 1year a fibre containing feed can be started in the first instance if the patient has been eating well prior to admission and has not undergone any recent gastrointestinal surgery.

The Dietitian should be informed of any patient who has started on enteral feeding out with working hours on the next working day.

Appendix 2

Example:

9 year old male

26kg (25th centile)

132cm (25th centile)

Hildreth Formula

Children < 12 years 1800 kcal / m² (sa) + 1300 kcal / m² (burn)

Surface area =

$$\sqrt{\frac{\text{Height (cm)} \times \text{Weight (kg)}}{3600}}$$

Burn =

surface area x % burn

9% scald

Hildreth 1800kcal X 0.98 + 1300kcal x 0.09

$$1764 + 117 = \underline{1881 \text{ kcal / day}}$$

Surface area = $132 \times 26 / 3600 = 0.95$ square root = 0.98

Burn = $0.98 \times 9\% = 0.09$

31% scald

Surface area as calculated above

Burn = $0.98 \times 31\% = 0.3$

Hildreth 1800kcal x 0.98 + 1300 x 0.3

$$1764 + 390 = \underline{2154 \text{ kcal / day}}$$

Appendix 3

Table 1: Summary of Reference Nutrient Intakes for Infants and Children

Age	Fluid ml/kg	EAR		Protein	
		kcal/kg	Kcal/DAY	g/kg	g/DAY
<i>Male</i>					
0-3 months	150	100-115	-	2.1	-
4-6	150	95	-	1.6	-
7-9	120	95	-	1.5	-
10-12	120	95	-	1.5	-
1-3 years	90	95	1230	1.1	14.5
4-6	80	90	1715	1.1	19.7
7-10	60	-	1970	-	28.3
11-14	50	-	2220	-	42.1
15-18	40	-	2755	-	55.2
<i>Female</i>					
0-3 months	150	100-115	-	2.1	-
4-6	150	95	-	1.6	-
7-9	120	95	-	1.5	-
10-12	120	95	-	1.5	-
1-3 years	90	95	1165	1.1	14.5
4-6	80	90	1545	1.1	19.7
7-10	60	-	1740	-	28.3
11-14	50	-	1845	-	41.2
15-18	40	-	2110	-	45.4

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