Midland Burn
Operational Delivery Network

The Nutrition and Dietetic Journey for the Burn Injured Patient within the Midland Burn Operational Delivery Network:

Guidelines for the Nutritional Management Of Adults and Paediatrics

Written: November 2011

Reviewed: June 2016

Review Date: June 2018

Contents

A.	Scope and Purpose	3
B.	Development Process	4-5
C.	Stakeholder Involvement	5-6
D.	Importance of Nutrition for Burn Injured Patients	7
E.	Definitions	8
F.	Summary Table of the Guidelines for the Nutritional Management of the Burn Injured Patient (Adults and Paediatrics)	9-15

Full Guidelines for the Nutritional Management of the Burn Injured Patient (Adults and Paediatrics)

1.	Weight and Height Monitoring	16
2.	Nutritional Screening and Dietetic Referral Including the management of Refeeding Syndrome	16-19
3.	Micronutrients and Trace elements	19-23
4.	Tube Feeding including preventing & solving complications	24-27
5.	Nil By Mouth (incl. tube feeding) Periods	28
6.	Parenteral Nutrition	28-29
7.	Diet	29-30
8.	Immuno-nutrition	30-31
9.	Anabolic Steroids	32
10.	Bowel Management	32-33
11.	Transfer	33
12.	Discharge	34
13.	Outpatient Care (Consultant and Dressing Clinic)	34-35
14.	Monitoring Nutritional Therapy	35-36

International Burn Injury Database (iBiD)	37
References	38-40
Appendices	40-50

1. Abbreviations
2. Midland Burn Operational Delivery Network Nutrition and Dietetic Handover Form
3. NICE (2013) Protocol for nutritional, anthropometric and clinical monitoring of nutritional support & Protocol for laboratory monitoring of nutrition support in adults.

Scope and Purpose

These guidelines aim to assist the Burn Care Multidisciplinary Team (MDT) to make decisions about appropriate nutritional care of the burn injured patient to achieve best possible outcome. They do not replace individual clinical preferences or local Trust policy but should guide the MDT on nutritional issues throughout the patient's burn care journey.

The aims of nutritional intervention are to:

- Minimise weight loss to <10%; maintain normal growth and development in paediatrics
- Preserve lean body mass
- Optimise wound healing and skin graft take
- Support the immune system
- Correct any pre-existing nutritional deficiencies
- Maintain bowel function
- Maintain gut integrity and reduce risk of bacterial translocation

Therefore consistent implementation of these guidelines should ensure that the above areas are addressed and the nutritional status of the patient is optimised at all stages of the patient's care.

Implementation of the guidelines should have a minimal impact on staff workload or cost to the service.

It is the MDT that needs to implement these guidelines. The development of separate documentation for specific guidelines may need to be addressed at a later stage.

Development Process

The Midland Burn Operational Delivery Network (MB ODN) developed a Nutrition Group from all professional groups involved in burns within the Network. The members of this group were asked to collect and share all local guidelines and audit data available to understand the present evidence base for nutrition and dietetic practice. With this knowledge, the group produced this guideline to ensure all areas that involved the nutritional management of a burns patient were addressed.

Nutritional interventions should ideally be evidence based and randomised control trials (RCTs) are the gold standard. However, the absence of good quality consistent evidence has been highlighted[1]. This is due to various factors, including ethical considerations, difficulty randomising trials, different patient populations and the number of variables that may affect a patient outcome. Masters and Wood[2] reviewed practice across several burns centres across the USA and Australia and found that practice still varied greatly in areas where evidence was inconclusive. Professional guidelines and consensus statements are available[3, 4, 5] and the working party used these as the basis for their recommendations.

The guidelines produced are very extensive and involve all members of the MDT particularly the medical and nursing staff to communicate and implement these guidelines. Therefore any guideline revision will be circulated to the wider Network burn care teams for comments.

It is the opinion of the MB ODN that these guidelines will provide a framework with which to provide best practice. Shared guidelines will improve consistency of care, aid transfer of patients across the Network and provide optimal nutritional care.

The Speech and Language Therapists (S&LT) were involved in initial development of these guidelines. Individual Trust services S&LT guidelines should be referred to and utilised as required.

These guidelines have been ratified by the MB ODN Management Board as will any future revisions.

Dietetic and Nutritional Networking within the Midland Burn Network

All members of the MDT should be encouraged to network within the MB ODN to exchange practice and expert opinion to aid practice. This may include specific:

- Protocols
- Resource development
- Learning/teaching opportunities
- Audit and research

The guidelines will be reviewed every 2 years and the MB ODN Audit Meeting is a forum to discuss and debate any new ideas for best practice within nutrition and dietetic care.
The membership of the development/ review group represents a wide spectrum of professionals with extensive experience of burn care between them.

The following can be contacted for information on these guidelines:

No	Name	Email	Profession	Paed/Adult	Location
1	Beth Howard	Elizabeth.Howard@uhb.nhs.uk	Dietitian	Adult	UHB
2	Tig Howells	Emily.howells@nuh.nhs.uk	Dietitian	Adult	NUH
3	Need details		Dietitian	Paed	BCH
4	Mary Kennedy	Mary.Kennedy@nuh.nhs.uk	Nurse	Adult / Paed	NUH
5	Clare Thomas	Clare.Thomas@bch.nhs.uk	Nurse	Paed	BCH
6	Sue Sharp	Sue.Sharp@uhb.nhs.uk	Nurse	Adult	UHB
7	Claire Porter	Claire.Porter@uhl-tr.nhs.uk	Nurse	Adult	UHL

Guideline Reviewers 2016

No	Name	Email	Profession	Paed/Adult	Location
1	Tig Howells	Emily.howells@nuh.nhs.uk	Dietitian	Adult	NUH
2	Mary Kennedy	Mary.Kennedy@nuh.nhs.uk	Nurse	Adult/Paed	NUH

Initial Guideline Development group

No	Name Email	Profession	Paed/Adult	Location
1	Megan Gallagher Megan.Gallagher@uhb.nhs.uk	Dietitian	Adult	UHB
2	Tracy Lovejoy Tracy.Lovejoy@nuh.nhs.uk	Dietitian	Adult	NUH
3	Holly Doyle Holly.Doyle@nuh.nhs.uk	Dietitian	Paed /Adult	NUH
4	Vanessa Hopkins Vanessa.Hopkins@bch.nhs.uk	Dietitian	Paed	BCH
5	Lily Valachou Evangelina.Vlachou@uhb.nhs.uk	SpR	Adult	UHB
6	Mary Kennedy Mary.Kennedy@nuh.nhs.uk	Nurse	Adult/Paed	NUH
7	Clare Thomas/Vicki Hibble Clare.Thomas@bch.nhs.uk Vicki.Hibble@bch.nhs.uk	Nurse	Paed	BCH
8	Claire Porter Claire.Porter@uhl-tr.nhs.uk	Nurse	Adult	UHL

Throughout the development and review of these guidelines, all individuals have been encouraged to liaise widely with their colleagues, in both MB ODN services and nationally. These guidelines have not been pre-tested but are an amalgam of multiple local, regional and national guidelines for the management of nutrition.

There has not been specific patient involvement in the development of these guidelines however all members of the development group have direct patient contact in burn care. .

Target Users

The target users for these guidelines are all clinical staff involved in burn care in the MB ODN, specifically:

- Dietetic Staff
- Burn anaesthetists
- Burn nursing staff
- Burn surgeons
- Other AHP staff (all professional groups)

The Importance of Nutrition for Burn Injured Patients

Nutrition is important for burn injured patients as *'extensive thermal injury elicits the most profound response to stress that the human body is capable of generating'* [6]. The body responds with the generation of a hypermetabolic state dominated by catabolism and mediated by both hormones and cytokines. This response is associated with an increased energy and protein requirements and can last for several months post burn injury[7].

The burn injured patient is nutritionally vulnerable for many reasons; including increased nutritional requirements; increased losses of protein and trace elements via wound exudate; repeated episodes of fasting for surgical procedures, pain, nausea, psychological distress and side effects of medication. It has been demonstrated that it is possible to maintain weight within acceptable limits[8]. For children and adolescents, normal growth and development in children needs to be considered.

The general aims of nutritional intervention are to:

- Minimise weight loss to <10% for Adults
- No weight loss to maintain normal growth and development in Paediatrics
- Preserve lean body mass
- Optimise wound healing and skin graft take
- Support the immune system
- Correct any pre-existing nutritional deficiencies
- Maintain bowel function
- Maintain gut integrity and reduce risk bacterial translocation

The whole MDT and the ward catering staff are responsible for providing the best possible nutritional care to burn injured patients. Dietitians have a central role in assessing patient's individual requirements and intakes; formulating individual nutritional and dietetic care plans; monitoring nutritional progress, in addition to providing educational support to all members of the MDT on nutritional issues.

Definitions

Adult	= over 16 years old
Elderly adults	= over 60 years old
Paediatric	= 16 years and younger

The categories of burn injury are as per the MB ODN definitions:

Minor

- Children <5% Total Body Surface Area (TBSA)
- Adults <15% TBSA
- Patients with no significant co-morbidity

Moderate

- Minor but require surgical or complex wound management
- Minor plus significant co-morbidity
- Children 5-20% TBSA
- Elderly 10-20% TBSA with no significant co-morbidity
- Adults 10-14% TBSA with PLUS pre-existing physical/learning disability, therapeutic diet required, poor pre-admission social history, significant hand & facial burns
- Adults 15-30% TBSA with no significant co-morbidity

Severe

- Inhalation injury
- Moderate but require surgical or complex wound management
- Multiple co-morbidities
- Children >20% TBSA
- Elderly >20% TBSA
- Adults >30% TBSA

Summary Table of the Guidelines for the Nutritional Management of the Burn Injured Patient (Adults and Paediatrics)

All recommendations are applicable to both adults and paediatrics unless stated otherwise. Please refer to the main text for full explanations- pages stated in brackets.

<table>
<tr><th></th><th>Minor</th><th>Moderate</th><th>Severe</th></tr>
<tr><td>1. Weight & Height Monitoring
(pg.16)</td><td colspan="3">Weight & height must be measured & documented on admission by Nursing / Ward staff stating if estimate or actual & reason if unable to be weighed. Weight should be repeated weekly.
For paediatrics plot measurements on a centile growth chart.
Any factors which may affect weight accuracy should be documented.</td></tr>
<tr><td rowspan="5">2. Nutritional Screening and Dietetic Referral
(pg.16-19)</td><td rowspan="5">Local Trust nutritional screening tool to be completed by Nursing / Ward staff within 24hrs of admission and repeated weekly whilst inpatient with referral to Dietitian as indicated.</td><td colspan="2">Local Trust nutritional screening tool to be completed by Nursing / Ward staff within 24hrs of admission and repeated weekly whilst inpatient.
Nursing staff / Doctors to refer to Dietitian (regardless of screening score) within 24hrs of admission.</td></tr>
<tr><td colspan="2">Dietitian to assess patient within 1 working day of receipt of referral.
Dietetic recommendations to be documented in patient hospital records.</td></tr>
<tr><td colspan="2">Nursing Staff to carry out 24hrs urine collections for N balance analysis as requested (Paediatrics- severe injury only)</td></tr>
<tr><td colspan="2">Burn staff to be aware of and consider patient risk of Refeeding Syndrome; Dietitian to assess if necessary; monitor K, Mg & PO_4 if refeeding risk. See NICE Clinical Guideline (CG32) or local Trust guidelines.</td></tr>
<tr><td></td><td>Use indirect calorimetry weekly for assessing energy requirements if available.</td></tr>
</table>

<table>
<tr><th></th><th>Minor</th><th>Moderate</th><th>Severe</th></tr>
<tr><td rowspan="6">3. Micronutrients & Trace Elements

(pg.19-23)</td><td colspan="3">Baseline nutritional bloods to be measured on admission then daily until stable, including U&Es, Alb, LFTs, full blood count, CRP, Ca, Mg & PO_4- see point 14 & Appendix 4 for NICE Clinical Guidelines (32).</td></tr>
<tr><td rowspan="5">Routine trace element prescription not indicated.</td><td colspan="2">Baseline trace elements (Se, Zn & Cu) to be measured on admission & repeated weekly until normal but interpreted with caution.</td></tr>
<tr><td colspan="2">Supplement with oral trace elements depending on baseline level & following dietetic assessment if <30% TBSA.</td></tr>
<tr><td>Routine use of IV supplementation not indicated</td><td>Commence IV trace element supplementation from admission for at least 8 days.

Use specific preparations, as per local Trust policy, within a specific policy/guideline.</td></tr>
<tr><td colspan="2">All <u>adult</u> patients to be supplemented with 1g ascorbic acid (vitamin C) /d starting within 24hrs & discontinuing as per Dietetic assessment.

Dietitian to assess all <u>paediatric</u> patients to ensure RNI for vitamin C intake is achieved as a minimum.</td></tr>
<tr><td colspan="3">All patients at risk of vitamin D deficiency should be prescribed a supplement as per local Trust policy. Monitor Ca & PO_4 weekly to avoid hypercalcaemia.</td></tr>
</table>

<table>
<tr><th></th><th>Minor</th><th>Moderate</th><th>Severe</th></tr>
<tr><td rowspan="4">4. Tube Feeding

(pg. 24-27)</td><td rowspan="3">Not generally indicated unless ventilated/heavily sedated.

Follow local Trust Nutritional Screening Tool.</td><td colspan="2">For burn injuries ≥15% TBSA place feeding tube & commence enteral feeding within 12-24 hrs [51]of admission using a standard starter protocol if available.

Care must be taken to avoid aggressive enteral nutrition when patient is still being stabilised due to risk of non-obstructive bowel necrosis.</td></tr>
<tr><td colspan="2">Nursing staff to refer to local Trust guidelines re: tube types, placement care & monitoring position.</td></tr>
<tr><td colspan="2">Jejunal feeding to be considered where appropriate including for patients with injuries ≥ 30% TBSA.</td></tr>
<tr><td colspan="2">Dietitian to provide an individual tube feeding regimen within 1 working day of receipt of referral.</td></tr>
<tr><td colspan="3">All Staff to be aware that the complications of tube feeding can be multifactorial as detailed in point 4.11.</td></tr>
<tr><td rowspan="3">5. NBM (incl. tube feeding) Periods

(pg.28)</td><td colspan="3">For gastrically fed patients Nursing staff to stop feeding 6 hours before any procedure under anaesthesia.

If NJ tube placed & documented in the correct position feed to continue throughout theatre unless stated otherwise.</td></tr>
<tr><td colspan="3">Any alternative plan should be documented by an Anaesthetist & Nursing staff given verbal instructions by them.

Nursing staff to contact patient’s Anaesthetist for confirmation & clarification if unsure.</td></tr>
<tr><td colspan="3">Dietitian to liaise with the MDT to alter feeding regimen as necessary.</td></tr>
</table>

<table>
<tr><th></th><th>Minor</th><th>Moderate</th><th>Severe</th></tr>
<tr><td>6. Parenteral Nutrition
(pg.28-29)</td><td>Not indicated</td><td colspan="2">Doctors to liaise with local Trust Gastro/ Nutritional Support Team if PN required.</td></tr>
<tr><td rowspan="4">7. Diet
(pg.29-30)</td><td rowspan="4">As per normal nursing care/ local Trust nutritional screening tool, including food & fluid charts.</td><td colspan="2">If patient under dietetic care or as per local Trust nutritional screening tool: food & fluid chart to be completed daily by Ward/Nursing staff.</td></tr>
<tr><td colspan="2">Dietitian to give verbal +/- written advice to patient/carer/Ward/Nursing staff to promote high protein diet & maintain regular bowel habits.
Oral nutritional support products to be prescribed as indicated by the Dietitian.</td></tr>
<tr><td colspan="2">All patients to be assisted by Ward/Nursing staff at mealtimes if necessary & suitable aids provided as per Rehabilitation Plan including appropriate seating/positioning.</td></tr>
<tr><td colspan="2">Swallowing impairments will be assessed by an S&LT within 48hrs from receipt of referral. Any other impairment for assessment by an S&LT will be assessed within 72hrs from receipt of referral.</td></tr>
<tr><td rowspan="2">8. Immuno-nutrition
(pg.30-31)</td><td rowspan="2">Not indicated</td><td rowspan="2">Not indicated</td><td>Give 0.5g/kg/ day glutamine daily for at least 5 days; monitor liver & renal function daily.</td></tr>
<tr><td>Arginine & omega-3 supplementation is not recommended.</td></tr>
</table>

	Minor	Moderate	Severe
9. Anabolic Steroids **(pg.32)**	Not indicated	Not indicated for injuries <25% TBSA in Adults	Consider on an individual basis once on full tube feed. **Dietitian** to assess nutritional intake to ensure adequate for steroid therapy. Weight to be monitored weekly by **Nursing/Ward staff** while on anabolic steroids.
10. Bowel Management **(pg.32-33)**	**Burns staff** should assess and document patients' normal bowel habits on admission.		
	All patients should have their bowel habits monitored & documented daily by **Nursing/Ward staff** & if concerns refer to Hospital Trust guidelines for recommended management & all medications to be reviewed.		
	Patients should be encouraged to consume an adequate fluid intake & higher fibre foods or the **Dietitian** should review the enteral feed, to aid bowel function.		
	Stool samples should be sent for microbial analysis for patients with diarrhoea as indicated in Hospital Trust policy.		
	Consider the use of a bowel management system on an individual patient basis.		
	The routine use of probiotics is not recommended.		

	Minor	Moderate	Severe
11. Transfer (pg.33)	**Dietitian** should handover nutrition and dietetic care plan to the receiving burn care service / dietitian within one working day of transfer using the dietetic MB ODN Nutrition and Dietetic handover form.		
12. Discharge (pg.34)	**Dietitian** to arrange outpatient follow up (internal or community), if necessary, especially severe burn injured patients and patients who were under the care of a Dietitian and receiving ONS products on discharge.		
	If prescribed ONS products or micronutrient supplements **Dietitian/Pharmacist** to arrange TTOs as per local Trust policy & a prescription request to GP to be completed by **Dietitian.** If patient being discharged on home enteral feed **Nursing/Ward staff/Dietitian** to liase to ensure correct enteral feed & equipment provided for home.		
	Dietitian to provide written advice & contact details as necessary.		
	Nursing/Ward staff to weigh patient on discharge & document.		
	All members of the MDT to promote healthy eating principles to maintain healthy weight & optimise future health once fully healed.		
13. Outpatient Care (pg.34- 35)	All Burn Services should ensure that **Clinic Staff** have adequate nutritional training to recognise nutritional related problems.		
	Burn Outpatient services should have a defined protocol for referral to appropriate Dietetic services.		
	Clinic staff to measure & document weight & height at each Consultant clinic appointment. If concern is related specifically to burn (e.g. poor wound healing or to improve nutritional status for burns surgery) **Clinic Staff/Doctor** to refer to Burn Dietitian.		

	Minor	Moderate	Severe
13. Outpatient Care **Continued** **(pg.34- 35)**	**Doctor/Nursing Staff** to refer general dietary concerns (e.g. obesity/iron and Vitamin D deficiency anaemia) to appropriate Health Professional (e.g. GP, Health Visitor) or to local Trust dietetic services.		
14. Monitoring Nutritional Therapy **(pg. 35-36)**	A range of biochemical and non biochemical parameters should be used to monitor the nutritional care of all patients. See NICE Clinical Guideline (CG32) & Appendix 4.		

Full Guidelines for the Nutritional Management of the Burn Injured Patient (Adults and Paediatrics)

1. Weight and Height Monitoring

1.1. An accurate weight is an essential part of the assessment of nutritional status and is vital for the calculation of drug doses. If a patient cannot be weighed the reason for this should be documented and if possible a Mid Upper Arm Circumference measurement (MUAC) can be used to monitor body weight. Any estimate of weight should be clearly stated as such. **Weight must be measured and documented on admission by Burns staff stating as estimate or actual and repeated on a weekly basis with a clear date history.**

1.2. Factors such as oedema secondary to fluid resuscitation, burns dressings and prosthetics can affect the accuracy of weights. **Any factors which may affect weight accuracy should be documented along with the weight so that it can be interpreted correctly.**

1.3. Height is essential to assess total burn surface area for predictive equations and to interpret whether a weight is healthy. For patients who cannot physically stand, measurement of ulna length will provide an approximate height (using BAPEN guide [53]). **A height (or length if under two years of age) must also be measured/ estimated on admission by Nursing/Ward staff.**

1.4. For paediatric patients, weight and height should both be plotted on a centile growth chart in the patient's medical records (and in parent's hand-held records if available) by Nursing/Ward staff.

2. Nutritional Screening and Dietetic Referral including the management of Refeeding Syndrome

2.1. Every in-patient should be nutritionally screened on admission by Nursing/Ward staff using a local Trust Nutrition Screening Tool. This should be repeated weekly as per local Trust policy.

2.2. Most screening tools are not specific for burn injury, so regardless of the screening outcome **Burns staff should refer all patients with moderate or severe burns to the Dietitian on admission.**

2.3. The Burns Interest Group (BIG) of the British Dietetic Association[9] states: 'all adults at risk of malnutrition, adults with injuries >15% TBSA, and facial, hand and electrical burns should be assessed by a Registered Dietitian.

2.4. **The Dietitian should assess moderate and severe injured patients within one working day of receipt of referral.** The Parenteral and Enteral Nutrition Group (PENG)[10] state that Dietitians should aim to see and assess all shock patients within 24hrs of admission; shock patients are identified by the American Burn Association (ABA)[3] as those who require formal fluid resuscitation i.e. burns >15% TBSA.

2.5. **Where possible weekly indirect calorimetry should be used by the Dietitian to estimate energy requirements in patients with severe burn injury** to avoid risk of both over- and underfeeding[4]. Dietitians should also adjust nutritional plans to account for energy, carbohydrate and lipid provided from non –nutritional sources such as Propofol and intravenous fluids.

It is important that if indirect calorimetry is used to assess requirements that it is repeated regularly as energy requirements will vary throughout the patient journey, depending upon the time since burn injury, activity, stress, area of burn healed and donor sites.

2.6. **If indirect calorimetry is unavailable, Dietitian to assess energy and protein requirements for all moderate and severe burns based upon age, sex, activity, stress and %TBSA using an appropriate nutritional equation at regular intervals** e.g. weekly, appropriate equations to consider are Henry 2005 or Toronto 1990. Protein requirements can be calculated using a range of 1.5g / kg to 2g/ kg a day for adults and 1.5-3.0g/kg/d in children.[51]

2.7. **Dietetic recommendations to be documented inpatient hospital records and discussed with MDT.**

Refeeding syndrome is defined as severe fluid and electrolyte shifts and related metabolic implications in malnourished patients undergoing refeeding[10].

2.8. Local Trust refeeding guidelines (if available) should be followed for those patients identified as at refeeding risk. If no local Trust guidance, then the National Institute of Clinical Excellence (NICE)[12] Refeeding Guidelines <u>for adults</u> should be followed as detailed below:

NICE classes a patient at a high refeeding risk if they have one or more of the following:

- Body Mass Index (BMI) less than 16 kg/m^2
- Unintentional weight loss greater than 15% within the last 3–6 months
- Little or no nutritional intake for more than 10 days
- Low levels of potassium, phosphate or magnesium prior to feeding

Or have two or more of the following:

- BMI less than 18.5 kg/m^2
- Unintentional weight loss greater than 10% within the last 3–6 months
- Little or no nutritional intake for more than 5 days
- A history of alcohol abuse or drugs including insulin, chemotherapy, antacids or diuretics

For patients at high risk of developing refeeding problems, the following precautions should be taken:

- Start nutrition support at a reduced rate under advice of dietitian (out of hours starter feeding regimens should provide no more than 10kcal/kg on day 1).
- Restore circulatory volume and monitor fluid balance and overall clinical status closely.
- Provide immediately before and during the first 10 days of feeding: oral thiamine 200–300 mg daily, vitamin B co strong 1 or 2 tablets three times a day (or full dose daily intravenous vitamin B preparation, if necessary) and a balanced multivitamin/trace element supplement once daily. For paediatric doses liaise with ward pharmacist.

- Pre-feeding correction of low plasma levels of magnesium, phosphate and potassium is unnecessary.
- On starting feeding blood magnesium, potassium, phosphate levels should be checked by medics. If low correct using oral, enteral or intravenous supplements of potassium, phosphate and magnesium as per local Trust refeeding guidelines. For paediatric doses liaise with ward pharmacist.

3. Micronutrients and Trace Elements

The role of antioxidant vitamins (vitamin A, C and E) and trace elements (e.g. zinc (Zn), selenium (Se)) in wound healing and immunity is well established. Benefits to antioxidant supplementation, particularly with selenium, has been shown for general critical care patients in a systematic review.[45] It has also been shown that trace elements are lost through burn exudate and depressed levels of some micronutrients have been demonstrated post burn injury[13]. Specific recommendations have been made by some authors[46]. However, consensus on supplementation is limited; please refer to own Hospital Trust policy,

Many commercially available tube feeds and oral nutritional support products contain substantial quantities of micronutrients, although Berger[13] cautions that intakes based on general population are not adequate for critically ill patients. ANZBA[5] however advises caution as 'excessive supplementation may result in a nutritional imbalance and may affect the utilisation of other nutrients'. Saffle and Graves[1] state that it is unclear whether additional micronutrient supplementation is of benefit to burn patients'.

More research from multicentre randomised controlled trials is needed specific to burns, in particular regarding level and duration of supplementation.

3.1. All patients to have baseline nutritional bloods to be measured on admission then daily until stable, including urea and electrolytes (U&Es), albumin (Alb), liver function tests (LFTs), full blood count, C-reactive protein (CRP), calcium (Ca), magnesium (Mg) and phosphate (PO_4)- see point 14 and Appendix 4 for NICE Clinical Guidelines (32).

3.2. If patient on tube feeds or oral nutrition support products the Dietitian will assess whether requirements are met without the need for any additional trace element or micronutrient supplementation.

Albumin is not considered a marker of malnutrition, and is of limited value in monitoring because of its long half life and because of its extra cellular fluid distribution, which makes it reflective of hydration and clinical condition rather than nutritional status[10].

Trace Elements

Trace elements are essential micro-nutrients as they cannot be synthesised in the body. They are particularly important to burn care as they are components of many enzymes which play roles in:

- Oxidative stress
- Wound healing including collagen cross-linking
- Immune function

The European Society of Parenteral and Enteral Nutrition (ESPEN) [14 51] recommend supplementing trace elements in a higher than standard dose post burn as stated below:

Trace Elements should be prescribed for at least:

- **7-8 days for burns >20-40%**
- **2 weeks for burns 40 -60%**
- **30 days for burns > 60%**

Berger[15] advises that trace element supplementation should be provided early, starting during the first hours after injury. Supplementation at higher than standard doses used in Berger's studies[37,39,41] and a Systematic Review by Kurmis [52] suggests a positive influence on length of stay, incidence of infections and grafting requirements.

There are currently no consistent UK supplement guidelines for adult and paediatric patients. Prelack K (2007)[43] describes a nutrient supplementation protocol used in

over 3 year olds in a Burn Centre in Boston, USA, although these guidelines have been criticised.[44] ESPEN (2013) [51] recommend all children < 5 years should have vitamin A,C,E supplementation. ANZBA (2007)[5] make daily recommendations for enteral zinc supplementation for burn injuries >20% TBSA depending on body weight.

Care should be taken when interpreting plasma measurements of trace elements due to effects of the acute phase response (APR) on body distribution.[11] Low serum levels of micronutrients 'may reflect a teleological response rather than a clinical deficit'[47]. A range of biochemical and non-biochemical parameters may need to be monitored to interpret trace element levels fully.

It would be advisable for the MDT to liaise closely with the Dietitian, pharmacist and biochemist when prescribing and monitoring trace element supplementation.

3.3. All adult and paediatric patients with moderate and severe burn injuries should have trace element status (Zn, Se and copper (Cu)) measured on admission and then weekly until normal.

3.4. Oral supplementation of trace elements should be prescribed for adult and paediatric patients with moderate to severe burn injuries, as per local Trust policy, if plasma levels are low following assessment by a Dietitian.

3.5. For <u>adults</u> and <u>paediatric</u> patients with severe burn injuries, IV trace element supplementation should be given within 24hrs for at least the first eight days post burn injury. The Dietitian should advice if supplementation is to continue for >8 days.

3.6. Specific preparations, as per local Trust policy, within a specific policy/guideline should be used liaising with a pharmacist as necessary to ensure safe treatment.

Suggested doses, per day, based on Berger's work[36-40] that could also be adjusted for paediatric patients are:

Cu 40-59µmol

Zn 400-574µmol

Se 3-4.8µmol

Vitamin C (ascorbic acid)

Vitamin C has a role in:

- Collagen synthesis and wound healing
- Immune system
- Enhance absorption of non-haem iron

Tanaka[16] also suggest that high dose vitamin C administration during first 24 hours post burn injury significantly reduces resuscitation fluid volume requirements and oedema. However, this paper[16] limits vitamin C supplementation to the first 24 hours for adult patients with >30% TBSA only. ESPEN (2013) [51] recommend 0.5g – 1.0g / day of Vitamin C for patients with > 15% TBSA burn and that Vitamin C and E intakes are 1.5 to 3 times higher than recommended daily intakes in both paediatrics and adults.

Glencourse[6] recommend a vitamin C intake post burn injury of 300-1000mg/d (over twenty times the recommended daily allowance). The risk of toxicity with vitamin C is low but effects with doses >1000mg/d can include oxalate stones diarrhoea and other gastro-intestinal (GI) symptoms. Berger[15] recommends a daily intake of 1-2g vitamin C. ANZBA[5] recommends a daily adult dose of 2g vitamin C for patients with severe burns but does not recommend a time-frame. There is no current evidence to recommend mega doses of vitamin C in the paediatric burn injured patient.

However it is recommended that the intake of vitamin C is gradually diminished over a 2-4 week period as rebound deficiency can occur post high dose supplementation[17].

3.7. All <u>adult</u> patients with moderate or severe burn injury should be supplemented with 1g ascorbic acid (vitamin C) per day starting within 24 hours post burn injury and discontinuing as per Dietetic assessment.

3.8. The Dietitian will assess all <u>paediatric</u> patients with moderate or severe burns to ensure the RNI for vitamin C intake is achieved as a minimum.

Vitamin D

Vitamin D deficiency impairs the absorption of dietary calcium and phosphorus, which can lead to bone deformities in children and bone pain and tenderness as a result of osteomalacia in adults. A significant proportion of the UK population have low vitamin D levels, which has resulted in a rising number of reported cases of rickets in children and osteomalacia in adults[18]. Vitamin D is synthesised from direct sunlight and Klein[19] reports that burn injuries cause an impairment of Vitamin D metabolism with reduced bone formation in children and adults.

The Scientific Advisory Committee on Nutrition (SACN) [18] advises that all patients who are at risk of vitamin D deficiency should be supplemented with vitamin D (10µg/d or 7µg/d for those five years of age or under).

At risk patients includes:

- Patients who may not be exposed to direct sunlight (either because of their burn injury, the skin is covered because of cultural reasons or who are confined indoors e.g. long term inpatients).
- All infants under age five years (unless taking at least 500ml infant formula per day).
- Pregnant and breast-feeding women.

3.9. All at risk patients should be supplemented with vitamin D as per local Trust policy. Preparations which contain vitamin A should be avoided in pregnant women due to the teratogenic risk of Vitamin A. Monitor Ca and PO_4 weekly to avoid hypercalcaemia.

3.10. If inpatients have received Vitamin D supplementation check level on discharge and liaise with G.P. for monitoring

4. Tube feeding

A Cochrane Review found that there is limited evidence to support early enteral feeding in burns patients but it has been demonstrated to be safe[1, 20] and current burns professional guidelines recommend commencing feed within 12hrs [3, 5, 51] and within 6 hours of admission for burns ≥ 20% TBSA (unless contra-indicated)[51]
Suggested benefits of early enteral feeding include; decreased incidence of infection and sepsis, decreased protein catabolism, reduced weight loss and duration of hospital admission[3]. Research does suggest that patients with burn injuries >15% TBSA show significant changes in micronutrient status with PENG and ANZBA recommending patients are enteral fed with this level of injury.

4.1. For adults with moderate and severe burn injuries ≥15% TBSA and for paediatric patients with ≥10% TBSA burn injuries a feeding tube should be placed and feeding commenced within 12 hours of admission.[5, 10]

Paediatrics or elderly adults with a smaller %TBSA burn may also require enteral feeding depending upon the adequacy of their oral intake or pre-existing nutritional status. Tube feeding may be indicated in other at risk patients (e.g. those with facial burns or pre existing malnutrition). Advice should be sought on an individual basis from a Dietitian and discussed with MDT.
The use of standard enteral feeding protocols, in a critical care setting, have been shown to be associated with significant improvements in nutrition practice compared with those that do not use them[35]. Such protocols could also be an advantage in a non-critical care setting to aid prompt feeding.
The American Society of Parenteral and Enteral Nutrition (ASPEN)[21] recommend closely scrutinising signs of gastric intolerance e.g. abdominal distension, hypoactive bowel sounds, increasing NG tube aspirates (gastric residual volume (GRV)), and increasing metabolic acidosis. If early enteral nutrition is not initiated and patient has aggressive fluid resuscitation it can cause generalised oedema including gut oedema and therefore increase the risk of paralytic ileus.[51]

4.2. Use standard naso-gastric (NG) starter feeding protocols until patient can be assessed by a Dietitian.

4.3. Care must be taken to avoid aggressive enteral nutrition when patient is still being stabilised due to risk of non-obstructive bowel necrosis[5].

Patients at increased risk include those experiencing:

- Severe trauma shock
- General vasoconstriction
- Hypovolaemia
- Bowel dysmotility

The safety of tube fed patients has prompted a recent National Patient Safety Agency (NPSA) alert[50]. Minimal standards have been set by the MB ODN but the MDT must refer to all local Trust policy and NPSA advice for detailed up-to-date recommendations.

4.4. Any patient fed via a NG tube or nasojejunal (NJ) tube should have the tube length at nostril recorded by Nursing staff each time a new bag of feed is started or tube changed.

4.5. Where possible, a fine-bore feeding tube should be placed for increased comfort.

Jejunal feeding

Jejunal feeding has been shown to be safe in burn injured patients[22], and has benefit of avoiding need for pre and intraoperative fasting.

4.6. For severe burn injury or pyloric dysfunction nasojejunal feeding should be considered in the following situations:

- ≥30% TBSA
- Patients > 15% up to 30% who may require frequent Theatre visits
- Expected to have frequent theatre visits thus require frequent NBM periods
- Confirmed gastric stasis
- Poor tolerance to gastric feeding (e.g. high GRVs, frequent vomiting)
- Unable to pass a NG tube therefore a NJ tube can be passed whilst in theatre

Delays to patients receiving adequate nutrition can be caused by frequent replacing of NG tube. This can also cause more distress to the patient. Studies have been

carried out, mainly in stroke patients, suggesting advantages to using NG tubes with a nasal sling fitting.[49]

4.7. For patients whose feeding tube is prone to being dislodged (e.g. secondary to confusion, vomiting or coughing) then a nasal sling should be considered.

NG feeding is generally considered a short term form of nutritional support. NICE guidelines[12] advise PEG placement should be considered for patients requiring enteral feeding > 4 weeks. It may be suitable for burn injured patients who require prolonged enteral feeding to have a PEG placed to improve patient comfort and nutrient delivery. However the decision should be made by the MDT in the context of the patient's surgical treatment and rehabilitation plan.

4.8. A Percutaneous Endoscopic Gastrostomy (PEG) should be considered (provided abdomen available for use) for large burns that require prolonged enteral feeding[23] or when it is difficult to fix an NJ or NG tube (i.e. large facial burns).

4.9. Higher protein infant formula or tube feeds are recommended; with a recommended calorie: nitrogen ratio of 100:1 in those with >10% TBSA burn and for <10% TBSA burn 150:1[1].

4.10. Dietitian will provide a written regimen stating type, rate and volume of feed within 1 working day of receipt of referral.

Indication for weaning feeds will need to be considered by the MDT on an individual basis. However, possible indications include: surgeons advise burn fully/almost completely healed, patient showing strong interest in diet and eating significant amounts of diet and/or oral nutrition support products.

4.11. Preventing and solving complications of tube feeding PENG[10]

Problem	Causes	Prevention	Treatment
Nausea, vomiting and/or abdominal distension	Rapid infusion of feed	Start slowly and gradually build up to prescribed volume	Review infusion rate
	Gastric stasis	Assess GRV in high risk patients	If vomiting or GRV > as stated in Local Trust Guidance consider prokinetics or post-pyloric feeding
	Side effects of medication		Review medication
	Constipation		Investigate & treat causes constipation
Constipation	Medication side effects	Provide estimated fluid requirements & monitor fluid balance	Review medication
	Inadequate fluid		Review fluid provision & provide extra if necessary
	Changes in gut motility		Consider enema/ laxatives
	Patient's inactivity	Encourage physical activity if possible	
	Lack of dietary fibre	Consider more routine use of fibre containing feeds	Review fibre content of feeding regimen
Diarrhoea	Medication side effects		Review medication
	Pre-existing bowel disorders		Consider antidiarrhoeal medication if no infection
	Rapid infusion of feed	Start slowly & gradually build up to prescribed volume	
	Infection (confirmed with positive stool sample(s)		
	Poor feed handling & administration techniques	Observe good hygiene practices	Use sterile packs for feeds and follow Trust guidance re: administration times
	Feed related factors		Review osmolarity & fibre content of feed
	Antibiotic associated diarrhoea	Probiotics may be effective in preventing antibiotic associated diarrhoea	
Overflow	Constipation	Prompt treatment of constipation to prevent patient becoming impacted	Consider enemas/laxatives
Re- feeding Syndrome	Malnutrition (when initiating nutritional support) Rapid infusion of nutrition support Lack of TPN $_3$ monitoring and replacement	Start slowly and gradually build up to prescribed volume of oral / enteral / parenteral nutrition	Review infusion rate Screen patients for Re-feeding according to Hospital Trust guidelines

5. Nil by Mouth (NBM) Periods

It should be a priority to minimize the number of hours of feeding lost by NBM episodes pre- and post-surgery[25]. Consideration needs to be given to the maximum possible duration for which patient may be off feeds (e.g. NBM pre theatre, during theatre and during post theatre recovery period).

5.1. The timing of the NG feeding regimen may require adjusting by the Dietitian on the days prior to theatre and post theatre to ensure the patient receives their full feed prescription.

5.2. Patients fed via a NG tube or PEG should have their feed stopped six hours before any procedure under anaesthesia. This fasting period may only be reduced if agreed by individual anaesthetists on a case by case basis.

5.3. If an alternative plan for fasting is to be followed, it is the responsibility of the patient's anaesthetist to give instructions to Nursing staff and document instructions in the medical notes.

5.4. If an NJ tube is placed and documented in the correct position, feed is to continue throughout theatre unless documented otherwise. Continuous enteral feeding throughout the operative and perioperative period via a NJ tube has been shown to be feasible, safe and clinically effective with reduced infection rates and increased calorie intake[22, 26].

5.5. If any member of the MDT is in any doubt regarding fasting times for an individual patient, then they should contact the relevant anaesthetist for clarification and confirmation.

6. Parenteral Nutrition (PN)

PN is an invasive and relatively expensive form of nutrition support, and in inexperienced hands, can be associated with risks from line placement, line infections and metabolic disturbance[12]. PN may be difficult to implement and maintain because of extensive skin loss and the risk of potential thrombotic complications.

6.1. Enteral nutrition should be considered the route of choice for the nutritional support of all burns patients, with functioning (or even partially functioning) gastrointestinal tracts.[1,4]

ESPEN (2013) recommend that PN should only be considered if enteral feeding fails[51]

6.2. All patients requiring PN should be referred to the Nutrition Support Team /Gastroenterology team as per local Trust policy.

6.3. If PN is indicated small amounts of enteral feeds should be given where possible to maintain gut integrity and reduce risk of bacterial translocation.

7. Diet

The whole MDT and the ward Catering staff are responsible for providing the best possible nutritional care to burn injured patients. An important part of this is ensuring all burns patients have access to and receive an appropriate diet to enable wound healing and independent self-feeding. Monitoring of dietary intake by all Burns staff is vital, as this enables the Dietitian to formulate individual nutritional and dietetic care plans and monitor nutritional progress.

7.1. Accurate food and fluid chart to be completed daily by Nursing/Ward staff as per local Trust nutrition screening tool.

7.2. Dietitian to give verbal and written advice to promote high protein and calorie diet and maintain regular bowel habits for all patients with moderate or severe burns, when it becomes appropriate to start encouraging significant intake of oral diet.

7.3. Oral nutrition support products to be prescribed as indicated by the Dietitian.

7.4. If snacks are available on ward, Ward staff to offer these between meals. The Dietitian may also liaise with family/visitors on most appropriate snacks they can bring in.

7.5. All patients who require assistance with feeding will be assisted by Ward/Nursing staff at mealtimes (e.g. elderly patients with dementia, patients with hand and facial burns).

7.6. Occupational Therapist to assess for adaptive cutlery or equipment and/ or seating/positioning whilst feeding as appropriate and provide a Rehabilitation Plan to aid independent feeding for patients who can chew and swallow but are unable to feed themselves.[12] This is of particular importance in patients with facial or hand burns.

7.7. If Dietitian/Nursing/Ward staff identify or are concerned about any potential swallowing impairment, the patient should be referred to a Speech and Language Therapist (S&LT) for assessment. Swallowing impairments will be assessed by an S&LT within 48 hours from receipt of referral. Any other impairment for assessment by an S&LT will be assessed within 72 hours[27] from receipt of referral.

Individual Trust services S&LT guidelines should be referred to and utilised as required.

7.8. Constipation can be a concern in this patient group due to opiate use and immobility therefore **patients who are constipated should be encouraged by the Burns staff to choose higher fibre meal and snack options and a feed containing fibre should be considered in tube fed patients.** See section 10.

8. Immuno-nutrition

Glutamine

Glutamine is a non-essential amino acid which has a number of important roles:

- It supplies energy to the liver and healing wounds
- It has a role in maintaining gut function and immunity
- It is a precursor of glutathione, an antioxidant

As glutamine has been shown to be quickly depleted from serum and muscle after burn injury it could be considered a 'conditionally essential' amino acid in burn care. This depletion is thought to contribute to muscle wasting, weight loss and infection[28]. Heyland[4] and Kreymann[14] recommend the use of glutamine in patients with burn injury.

However the optimal dose, route, administration method and period of glutamine supplementation have not yet been determined.

0.5g/kg is suggested as an effective dose in burns patients and has been shown to be safe in paediatric and adult patients[28, 29]. The literature generally refers to studies with severe burns only. Duration of supplementation is still under investigation but it is recommended that supplementation continues for 2-3 weeks post burn or until tube feeding is discontinued if earlier[29].

8.1. **All patients with severe burns to be given 0.3g/kg/d glutamine for at least five days but ideally for 2-3 weeks post burn (or until tube feeding discontinued if earlier).[51]** It can be administered via a feeding tube as boluses with water. Some specialist feeds may already contain some glutamine and the Dietitian will advise on adjusted dose if applicable.

8.2. **As ammonia is an end product of glutamine metabolism, renal and liver function should be monitored daily for patients on glutamine supplements and the dose reduced or stopped accordingly.**

Arginine

Arginine is another amino acid that has been investigated in trials for burns and trauma patients. Heyland[4] recommend that it is not used as there is potential to cause harm in septic patients with no proven benefit.

8.3. **There is no evidence for Arginine supplementation in burn injured patients as noted by ESPEN (2013)[51] so not recommended.**

Omega-3

Theoretically omega-3 fatty acids, particularly Eicosapentaenoic Acid (EPA), could prevent muscle wasting in critically ill patients due to their pro-inflammatory properties however the evidence is still emerging. There are no trials specific to burns that have been carried out and no professional recommendations[15].

8.4. **Omega 3 fatty acid supplementation is currently not recommended,** however many high protein feeds are now supplemented with Omega 3 fish oils**.**

9. Anabolic Steroids

The catabolic response to a severe body burn leads to a rapid loss of body weight, mostly lean body mass[30]. This process of net protein loss is attenuated but certainly not prevented by optimum nutrition, early wound closure, and physical therapy.

Oxandralone is the most widely studied anabolic steroid and ESPEN (2013) found that if it was given 10mg / 12 hours it has been shown to improve lean body mass by increasing net muscle protein synthesis, thereby attenuating muscle wasting and overall reduced mortality and length of stay.[31, 32, 51] Similar effects have been seen in paediatrics when prescribed 0.1g/ kg/ 12 hours.[51] It has been safely used in paediatric burns patients with severe burns[31] and in geriatric population with burns >10% TBSA[32]. Oxandralone has been shown to cause increased hepatic enzymes[33] so monitoring LFTs may be advisable.

9.1. The use of anabolic steroids should be considered on an individual basis but are not usually indicated for injuries

Adults <25 TBSA.

9.2. Anabolic steroids should not be prescribed until patients are established on their goal feeding regimen as the energy and protein intake will be inadequate for this type of therapy.

9.3. The Dietitian must be made aware of any patient where anabolic steroids (e.g. Oxandrolone) are being considered so that adequate energy and protein intake can be ensured Protein requirements can be calculated using a range of 1.5g / kg to 2g/ kg a day for adults and 1.5-3.0g/kg/d in children.[51]

9.4. Regular monitoring of weight by Burns staff is essential for patients on anabolic steroids as there is a risk of excessive weight gain and dosage should be reviewed on regular basis.

10. Bowel Management

10.1. Burns staff should assess and document patients normal bowel habits on admission.

10.2. All patients should have their bowel habits monitored and documented daily, by Burns staff, and if concerns refer to Hospital

Trust guidelines for recommended management & all medications to be reviewed.

10.3. A bowel management system should be considered on an individual patient basis (e.g. burns to perianal area). These systems are not recommended for use in paediatric patients, but may be considered on an individual basis for older adolescent patients.

10.4. Patients should be encouraged to consume an adequate fluid intake and higher fibre foods to aid bowel function

10.5. Dietitian to consider a fibre-enriched feed and adjust the feed fibre content depending upon bowel habits Trier[34] and ESPEN [51] reports that the use of fibre-enriched feeds reduces the incidence of constipation and laxative use.

10.6. Patients with diarrhoea should have a stool sample sent for microbial analysis to exclude infective causes as per local Trust Guidance

10.7. Loose stools/or constipation may be a side-effect of medication (e.g. oral magnesium and antibiotics) - medication should be reviewed where possible.

There is some, although limited, evidence to suggest that probiotic drinks are effective at managing antibiotic associated, C difficile and enteral tube feeding associated tube feeding diarrhoea.[42]

10.8. The routine use of probiotics is not indicated for the bowel management of the burn injured patient.

11. Transfer

11.1. Dietitian should handover nutrition and dietetic care plan to the receiving burn care service / dietitian within one working day of transfer using the dietetic MB ODN Nutrition and Dietetic handover form.

12. Discharge

12.1. Nursing/Ward staff to weigh patient or measure MUAC on discharge and document.

12.2. Written dietary information, with contact details, to be given by the Dietitian if necessary.

12.3. If post discharge use of ONS products or micronutrient supplements indicated Dietitian/Pharmacist to arrange TTO (depending upon local Trust policy). Dietitian to write to GP with recommendations for prescription.

12.4. Dietitian to arrange outpatient follow up (internal or community) if necessary, especially severe burn injured patients and patients who were under the care of a Dietitian and receiving ONS products on discharge.

12.5. If patient being discharged on home enteral feed Dietitian and Nursing/Ward staff to liaise to arrange training, feed delivery and TTO (depending upon local Trust policy).

12.6. Once fully healed and appetite no longer a concern, patients should be encouraged to consume a varied, balanced diet following basic healthy eating principles to avoid any unnecessary weight gain and ensure good future health.

12.7. Patients who have received Vitamin D supplementation require levels taking prior to discharge and G.P. to be informed.

13. Outpatient Care

The hypermetabolic response is associated with an increased requirement of energy and protein that can last for >9 months after burn injury.[2]

13.1. All Burn Services should ensure that Clinic Staff have adequate nutritional training to recognise nutritional related problems.

13.2. Burn Outpatient services should have a defined protocol for referral to appropriate Dietetic services.

13.3. All patients should have their weight and height (length for paediatrics) monitored by Clinic staff at every Consultant clinic appointment.

13.4. If concerns that nutritional status may be affecting wound healing Clinic Staff to refer to Burn Dietitian for assessment.

13.5. For nutritional concerns unrelated to wound healing (e.g. obesity/allergy) Clinic staff to refer to GP or to local Trust dietetic services.

14. Monitoring Nutritional Therapy

Any nutritional therapy should be monitored[12] to:

- Ensure nutritional support is provided safely, and to detect and treat clinical complications as early and effectively as possible.
- Assess the extent to which nutritional objectives have been reached.
- Alter the type of nutrition support, or the components of the regimen, to improve its effectiveness and to minimise or prevent metabolic complications.

However to achieve the objectives stated above monitoring protocols which integrate a variety of observations and measurements are required. NICE (2013)[12] make a number of recommendations for **adults** receiving oral nutritional support, enteral tube feeding and parental nutrition (see Appendix 4) but these are **not specific to burn care**. Care in interpreting laboratory tests is highlighted by NICE particular when patients are subject to the effects of the APR or systemic inflammatory response syndrome (SIRS).

Specific to burn care a variety of biochemical and non-biochemical parameters have been suggested for patients with burn injuries >15% TBSA, as detailed in the tables below.

Biochemical Monitoring Parameters for Post Burn Injured Patients.[10, 43, 47]

Parameter	Frequency
Serum urea and electrolytes	Daily during the first week, then twice weekly
Glucose	4 hourly during first 24 hours, thereafter as indicated; PENG- daily for first week
Serum albumin	Twice weekly
C-Reactive Protein	Twice weekly
Liver Function Tests (LFTs)	Twice weekly
Calcium Magnesium Phosphate	Twice weekly PENG- PO_4 daily for first week, then weekly; Ad.Ca weekly
Haemoglobin & White Cell Count	Twice weekly PENG- for the first month (minimum)
Trace Elements PENG- serum Cu, Zn & Mg	Weekly PENG- Days 7,14,21 for TBSA >20%

Non-Biochemical Monitoring Parameters for Post-Burn Injured Patients.[10, 47, 48]

Parameter	Frequency
Body Weight	Weekly then monthly on discharge
Nitrogen balance	Daily for first 2 weeks
TBSA left to heal	Daily
Graft sites	Daily

14.1 All patients should be monitored using a variety of parameters as per their nutritional care and monitoring plan involving the whole MDT.

14.2 Burns Staff to consider the impact that psychological distress can have on appetite, ability to eat and bowel motions. For patients where there is any concern, this should be explored and addressed and referred to clinical psychology if required.

Burn Injury Database (iBID)

The Data Collector to liaise with the Dietitian if more information required.
Information will include:

- Patients' pre admission dietary history e.g. weight, balanced diet, takes food supplements / vitamins, Meals on Wheels, dentures.
- In patient dietary history comment box e.g. NG / NJ feeding regime
- Dietitian Input with patients indicated in minutes (Daily dependency)

Applicability

The MB ODN believes that these guidelines are immediately applicable. There may need to be agreement on the most appropriate place for recording of the guidelines and documentation of subsequent actions.

Editorial Independence

These guidelines have been produced without funding or influence from any external body.

All members of the development group declare that they have no conflicts of interest related to any aspect of these guidelines.

References

1. Saffle, J. & Graves, C. (2007) Nutritional Support of the Burned Patient *in:* Herndon, D. *Total Burn Care (3rd Ed.)* Saunders Elsevier
2. Masters, B. and Wood, F (2008). Nutrition Support in Burns – is there consistency in practice? *J Burn Care Research* **29** pp 561-571
3. Saffle J et al (2001) American Burns Association. Practice Guidelines for Burn Care. *Journal of Burn Care & Rehabilitation* **22** pp S1-69.
4. Heyland D (2003) Canadian clinical practice guidelines for nutrition support in mechanically ventilated, critically ill adult patients. *Journal Parenteral Enteral Nutrition* **27**(5) pp 355-374.
5. Australian and New Zealand Burn Association (ANZBA) (2007) *Burn Survivor Rehabilitation: Principles and Guidelines for the Allied Health Professional*
6. Glencourse, G. and British Dietetic Association's Burns Interest Group. (2007) Burn Injury *In:* Thomas, B. *Manual of Dietetic Practice.* Oxford: Blackwell Science.
7. Hart,D. et al. (2000) Persistence of muscle catabolism after severe burn, *Surgery* **128**(2) pp. 312-319
8. Windle, M. (2004) Audit of successful weight maintenance in adult and paediatric survivors of thermal injury at a UK regional burn centre. *Journal Human Nutrition and Dietetics* **17**, pp. 435-441.
9. Burn Interest Group of The British Dietetic Association. (2004) *Feeding Guidelines for Adult Burned Patients (2nd Ed.)* Birmingham: BDA
10. Parental and Enteral Nutrition Group (PENG) of the British Dietetic Association (2007) *A Pocket Guide to Clinical Nutrition. Third Edition* Birmingham: BDA
11. Windle M (2008) Nutrition support in major burn injury. Case analysis of dietetic activity, resource use and cost implications. *Journal of Human Nutrition and Dietetics* **21** pg 165-173
12. National Institute of Clinical Illness (NICE) (2013) *Nutrition support for adults: Oral nutrition support, enteral tube feeding and parenteral nutrition*
13. Berger, M (2006) Antioxidant Micronutrients in Major Trauma and Burns: Evidence and Practice. *Nutrition in Clinical Practice* **21** pp438-449
14. Kreymann K et al (2006) European Society for Parenteral and Enteral Nutrition (ESPEN) Guidelines on enteral nutrition: intensive care. *Clinical Nutrition* **25** pp210-223.
15. Berger M (2009) Basics in clinical nutrition: Nutritional support in burns patients. *The European e-Journal of Clinical Nutrition and Metabolism* **4**: e308-e312.
16. Tanaka H *et al* (2000) Reduction of resuscitation fluid volumes in severely burned patients using ascorbic acid administration: a randomized, prospective study. *Archives of Surgery* **135**(3) pp326-331
17. Jacob R. (1994) Vitamin C, cited in *Advanced Nutrition and Human Metabolism, Second Edition.* Groff J *et al*. USA: West Publishing Company.
18. Scientific Advisory Committee on Nutrition (SACN) (2007) *Update on Vitamin D Position Statement.*
19. Klein G *et al* (1993) Bone disease in burn patients. *J Bone Miner Res* **8** pp337-345
20. Wasiak J, Cleland H and Jeffrey R (2006) Early versus delayed enteral nutrition support for burns injuries. *Cochrane Database of Systemic Reviews* **3**
21. McClave S, Martindale R et al. (2009) Guidelines for the provision and assessment of nutrition support in the adult critically ill patient. Society of Critical

Care Medicine (SSCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). Journal of Parenteral and Enteral Nutrition **33** pp271-316
22. Jenkins, M, Gottschlich M, Mayes T et al (1994). Enteral feeding during operative procedures. *J. Burn Care Rehabil* **15** pp401-415
23. Kreis B, Middelkoope E, Vloemans A and Kreis R (2002). The use of a PEG in a burn centre. *Burns* **28** pp191-197
24. Horn D, Chaboyer W and Schluter PJ (2004) Gastric residual volumes in critically ill paediatric patients: A comparison of feeding regimens. *Australian Critical Care* **17** pp98-103
25. Mayes. T. et al (1997) Clinical Nutrition Protocols for Continuous Quality Improvements in the Outcomes of Patients with Burns. *Journal of Burn Care and Rehabilitation* **8** pp365-8.
26. Sefton EJ, et al (2002). Enteral feeding in patients with major burn injury: the use of nasojejunal feeding after the failure of nasogastric feeding. *Burns* **28** pp386-90.
27. Royal College of Speech and Language Therapists Clinical Guidelines (2005).
28. Windle M (2006). Glutamine supplementation in critical illness: evidence, recommendations and implications in clinical practice for burn care. *J Burns Care Res* **27** pp 764-772
29. Ward, E et al (2003) Oral Glutamine in Paediatric Oncology Patients: a Dose Finding Study. *Eur J Clinical Nutrition* **57** pp31-36.
30. Demling R. (2009) Nutrition, anabolism and the wound healing process: an overview. Open Access Journal of Plastic Surgery **9** pp65-94
31. Hart D, Wolf S, Romzy P et al (2001). Anabolic effects of oxandralone after severe burn. *Annals of Surgery.* Volume **233** (4) pp556-564
32. Demling R, DeSanti L. (2003) The beneficial effects of oxandralone in the geriatric population. *Wounds* **15**(2)
33. Jeschke M, Finnerty C, Suman O et al. (2007) The effect of oxandralone on the endocrinolgic, inflammatory and hypermetabolic responses during acute phase post burn. *Annals of Surgery.* **246**(3) pp351-366
34. Trier *et al* (1999) Effect of a multifibre supplemented paediatric feed on gastrointestinal function. *J Gastroenterol Pediatric Nutr* **28** pp595
35. Heyland D *et al* (2010) Impact of enteral feeding protocols on enteral nutrition delivery. Results of a multicenter observational study. *Journal of Parenteral and Enteral Nutrition* 34(6):675-684.
36. Berger M *et al* (1994) Influence of large intakes of trace elements on recovery after major burns. Nutrition 10(4):327-334.
37. Berger M *et al*. (1998) Trace element supplementation modulates pulmonary infection rates after major burns: a double-blind, placebo-controlled trial. American Journal Clinical Nutrition 68:365-71.
38. Berger M *et al* (2004) Trace element supplements influence protein metabolism and tissue levels after major burns. Intensive Care Medicine 30(suppl):S61
39. Berger M *et al* (2007a) Trace element supplementation after major burns modulates antioxidant status and clinical course by way of increased tissue element concentrations. American Journal of Clinical Nutrition 85:1293-1300.
40. Berger M *et al*. (2007b) Trace element supplementation after major burns increases burned skin trace element concentrations and modulates local protein metabolism but not whole-body substrate metabolism. American Journal of Clinical Nutrition 85:1301-1306.

41. Berger M *et al*. (2006) Reduction of nosocomial pneumonia after major burns by trace element supplementation: aggregation of two randomised trials. Critical Care 10:R153.
42. Weichselbaum E (2009) Probiotics and Health: a review of the evidence. *Nutrition Bulletin* 34: 340-373.
43. Prelack K *et al* (2007) Practical guidelines for nutritional management of burn injury and recovery. Burns 33(1):14-24.
44. Berger M, Shenkin A and Raffoul W (2008) Letter to the Editor: 'Practical guidelines for nutritional management of burn injury and recovery'- A guideline based on expert opinion but not including RCTs. Burns 34:141-143.
45. Heyland D *et al* (2005) Antioxidant nutrients: a systematic review of trace elements and vitamins in the critically ill patient. Intensive Care Med 31(3):327-337.
46. Prins A (2009) Review: Nutritional Management of the burn patient. South Africa Journal of Clinical Nutrition 22(1):9-15.
47. Manual of Dietetic Practice, Fourth Edition (2007). Edited by Thomas B and Bishop J in conjunction to the British Dietetic Association. Oxford: Blackwell Publishing.
48. Total Burn Care, Third Edition. Herndon D *et al* (2007) Philadelphia, USA: Saunders Elsevier; Chapters 28, 30 & 31.
49. Beavan J, Conroy S P, Harwood R, Gladman J R F, Leonardi-Bee J, Sach T, Bowling T, Sunman W, Gaynor C. (2010) Does looped nasogastric tube feeding improve nutritional delivery for patients with Dysphagia after acute stroke? A randomised controlled trial. Age and Aging 39:624-630.
50. National Patient Safety Agency (2011) Reducing the harm caused by misplaced Nasogastric feeding tubes in adults, children and infants. National Health Service.
51. Rousseau A-F, et al. (2013) ESPEN endorsed recommendations: Nutritional Therapy in Major Burns, Clinical Nutrition
52. Kurmis R et al. (2015) Trace Element Supplementation following Severe Burn Injury: A Systematic Review and Meta – Analysis. Journal of Burn Care and Research. Volume 37 - Issue 3 pp: 143-195**.**
53. BAPEN.2003.Malnutrition Advisory Group MAG, a Standing Committee of BAPEN. Reviewed and reprinted August 2011.

Appendices

1. Abbreviations
2. Midland Burn Operational Delivery Network Nutrition and Dietetic Handover Form
3. NICE (2006) Protocol for nutritional, anthropometric and clinical monitoring of nutritional support & Protocol for laboratory monitoring of nutrition support in adults.

Appendix 1

Abbreviations

ABA	American Burns Association
AHP	Allied Health Professional
Alb	Albumin
ANZBA	Australian & New Zealand Burn Association
APR	Acute Phase Response
ASPEN	American Society of Parenteral and Enteral Nutrition
BCH	Birmingham Children's Hospital
iBID	Burn Injury Database
BIG	Burns Interest Group
BMI	Body Mass Index
Ca	Calcium
cm	centimetre
Cr	Creatinine
CRP	C-Reactive Protein
Cu	Copper
d	day
ESPEN	European Society of Parenteral & Enteral Nutrition
g	gram
GI	gastro-intestinal
GP	General Practitioner
GRV(s)	Gastric residual volume(s)
hrs	Hours
IV	Intravenous

K	Potassium
kg	kilogram
LFTs	Liver Function Tests
MB ODN	Midlands Burn Operational Delivery Network
MDT	Multi-Disciplinary Team
Mg	Magnesium
mg	milligram
µg	microgram
MUAC	Mid Upper Arm Circumference measurement
N	Nitrogen
NBM	Nil by Mouth
NG	Nasogastric
NICE	National Institute for Clinical Excellence
NJ	Nasojejunal
NSPA	National Patient Safety Agency
NUH	Nottingham University Hospitals
PENG	Parenteral & Enteral Nutrition Group
PEG	Percutaneous Endoscopic Gastrostomy
PN	Parenteral Nutrition
PO_4	Phosphate
RCT(s)	Randomised Controlled Trial(s)
SACN	Scientific Advisory Committee on Nutrition
S&LT	Speech & Language Therapist
Se	Selenium
TBSA	Total Body Surface Area

TTO	To Take Out
U	Urea
UHB	University Hospitals Birmingham
UHL	University Hospital Leicester
U&Es	Urea and electrolytes
Zn	Zinc

Appendix 2

Midland Burn
Operational Delivery Network

Nutrition and Dietetic Handover Form

This form is to be completed by the Dietitian to aid nutrition and dietetic handover of burn injured patients **within the Midlands Burn Operational Delivery Network (MB ODN)and transferring or receiving patients outside the region, in conjunction with the MB ODN Repatriation Form.** It can be e-mailed (via a secure NHS address), faxed or posted but does not replace a verbal handover.

delete as appropriate

Patient's Name: ……...

Date of Birth: ……...

Date of transfer: ……..…… to **Critical Care/Burns Unit/Outpatient***

Patient Injury Details

Date Of Injury	
% TBSA / Depth of Injury / Location	
Surgical Procedures / Skin grafting	
Relevant Past Medical History	

Anthropometrics

Date

Pre-burn injury weight: ……kg (estimate/actual*) ……..

Dry admission weight: ……kg (estimate/actual*) ……..

Current weight: ……kg (estimate/actual*) ……..

Height: ……..m (estimate/actual*)

Other anthropometrics/ weight history: ……

……

Does Patient have any Nutritional Allergies Yes / No

State if any:

Current Nutritional Requirements

Energy: ….……..…….kcal/d Protein: ……..……g/d

Equation Used: ……

Current Method(s) of Nutrition Support *(tick all that apply)*

NG □ Type of tube: …… Date placed: ……..

NJ □ Type of tube: …… Date placed: ……..

ONS products (prescribable) □

ONS products (non-prescribable) □

Nutrient or trace element supplements (medicines) □

Food first principles/high protein diet □

Summary of Dietetic Intervention including ONS products/enteral feeds already tried:

……

……

……

……

……

……

Relevant Social History including details of normal eating pattern and food/drink preferences:

……

……

……

……

Functional Status at Transfer i.e. ability to eating and drink or equipment aids used:

……

Current Bowel Habits: ……

Specific Nutritional Aims/Nutritional Care Plan:

……

……

<u>Current Dietetic Plan</u> including clear details of ONS products, feeding regimens, nutrient supplements prescribed

……

……

……

<u>Nutrient and Trace Element Biochemistry History</u> *(or attach printouts)*

	Units	**Date**							
Copper									
Zinc									
Selenium									
Fe									
Ferritin									
Folate									
Vitamin B12									
Alb									
TPro									
PO_4									
Ad Ca									
Mg									

Additional Comments:

Signed: …….. **Date:** ……

Print name: ……..…….

Hospital: ……..……..

Contact Telephone Number: ……

Appendix 3

NICE (2006) Protocol for nutritional, anthropometric and clinical monitoring of nutrition support in adults and NICE (2013) Nutrition Support in Adults: Evidence Update.

Parameter	Frequency	Rationale
Nutritional		
Nutrient intake from oral, enteral or parenteral nutrition (including any change in conditions that are affecting food intake)	Daily initially, reducing to twice weekly when stable	To ensure that patient is receiving nutrients to meet requirements and that current method of feeding is still the most appropriate. To allow alteration of intake as indicated
Actual volume of feed delivered*	Daily initially, reducing to twice weekly when stable	To ensure that patient is receiving correct volume of feed. To allow troubleshooting
Fluid balance charts (enteral and parenteral)	Daily initially, reducing to twice weekly when stable	To ensure patient is not becoming over/under hydrated
Anthropometric		
Weight*	Daily if concerns regarding fluid balance, otherwise weekly reducing to monthly	To assess ongoing nutritional status, determine whether nutritional goals are being achieved and take into account both body fat and muscle
BMI*	Start of feeding and then monthly	
Mid-arm circumference*	Monthly, if weight cannot be obtained or is difficult to interpret	
Triceps skinfold thickness	Monthly, if weight cannot be obtained or is difficult to interpret	
GI function		
Nausea/vomiting*	Daily initially, reducing to twice weekly	To ensure tolerance of feed
Diarrhoea*	Daily initially, reducing to twice weekly	To rule out any other causes of diarrhoea and then assess tolerance of feeds
Constipation*	Daily initially, reducing to twice weekly	To rule out other causes of constipation and then assess tolerance of feeds
Abdominal distension	As necessary	Assess tolerance of feed
Enteral tube – nasally inserted		
Gastric tube position (pH less than or equal to 5.5 using pH paper – or noting position of markers on tube once initial position has been confirmed)	Before each feed begins	To ensure tube in correct position

Parameter	Frequency	Rationale
Nasal erosion	Daily	To ensure tolerance of tube
Fixation (is it secure?)	Daily	To help prevent tube becoming dislodged
Is tube in working order (all pieces intact, tube not blocked/kinked)?	Daily	To ensure tube is in working order
Gastrostomy or Jejunostomy		
Stoma site	Daily	To ensure site not infected/red, no signs of gastric leakage
Tube position (length at external fixation)	Daily	To ensure tube has not migrated from/into stomach and external over granulation
Tube insertion and rotation (gastrostomy without jejunal extension only)	Weekly	Prevent internal over granulation/prevention of buried bumper syndrome
Balloon water volume (balloon retained gastrostomies only)	Weekly	To prevent tube falling out
Jejunostomy tube position by noting position of external markers	Daily	Confirmation of position
Parenteral nutrition		
Catheter entry site*	Daily	Signs of infection/inflammation
Skin over position of catheter tip (peripherally fed people)*	Daily	Signs of thrombophlebitis
Clinical condition		
General condition*	Daily	To ensure that patient is tolerating feed and that feeding and route continue to be appropriate
Temperature/blood pressure	Daily initially, then as needed	Sign of infection/fluid balance
Drug therapy*	Daily initially, reducing to monthly when stable	Appropriate preparation of drug (to reduce incidence of tube blockage). To prevent/reduce drug nutrient interactions
Long-/short-term goals		
Are goals being met?*	Daily initially, reducing to twice weekly and then progressively to 3–6 monthly, unless clinical condition changes	To ensure that feeding is appropriate to overall care of patient
Are goals still appropriate?*	Daily initially, reducing to twice weekly and then progressively to 3–6 monthly, unless clinical condition changes	To ensure that feeding is appropriate to overall care of patient
People at home having parenteral nutrition should be monitored using observations marked *.		

NICE (2006) (2013) Protocol for laboratory monitoring of nutrition support in adults.

Parameter	Frequency	Rationale	Interpretation
Sodium, potassium, urea, creatinine	Baseline Daily until stable Then 1 or 2 times a week	Assessment of renal function, fluid status, and Na and K status	Interpret with knowledge of fluid balance and medication Urinary sodium may be helpful in complex cases with gastrointestinal fluid loss
Glucose	Baseline 1 or 2 times a day (or more if needed) until stable Then weekly	Glucose intolerance is common	Good glycaemic control is necessary
Magnesium, phosphate	Baseline Daily if risk of refeeding syndrome Three times a week until stable Then weekly	Depletion is common and under recognised	Low concentrations indicate poor status
Liver function tests including International Normalised Ratio (INR)	Baseline Twice weekly until stable Then weekly	Abnormalities common during parenteral nutrition	Complex. May be due to sepsis, other disease or nutritional intake
Calcium, albumin	Baseline Then weekly	Hypocalcaemia or hypercalcaemia may occur	Correct measured serum calcium concentration for albumin Hypocalcaemia may be secondary to Mg deficiency Low albumin reflects disease not protein status
C-reactive protein	Baseline Then 2 or 3 times a week until stable	Assists interpretation of protein, trace element and vitamin results	To assess the presence of an acute phase reaction (APR). The trend of results is important
Zinc, copper	Baseline Then every 2–4 weeks, depending on results	Deficiency common, especially when increased losses	People most at risk when anabolic APR causes Zn ↓ and Cu ↑
Selenium[a]	Baseline if risk of depletion Further testing dependent on baseline	Se deficiency likely in severe illness and sepsis, or long-term nutrition support	APR causes Se ↓ Long-term status better assessed by glutathione peroxidase
Full blood count and MCV	Baseline 1 or 2 times a week until stable Then weekly	Anaemia due to iron or folate deficiency is common	Effects of sepsis may be important
Iron, ferritin	Baseline Then every 3–6 months	Iron deficiency common in long-term parenteral nutrition	Iron status difficult if APR (Fe ↓, ferritin ↑)

Folate, B12	Baseline Then every 2–4 weeks	Iron deficiency is common	Serum folate/B12 sufficient, with full blood count
Manganese[b]	Every 3–6 months if on home parenteral nutrition	Excess provision to be avoided, more likely if liver disease	Red blood cell or whole blood better measure of excess than plasma
25-OH Vit D[b]	6 monthly if on long-term support	Low if housebound	Requires normal kidney function for effect
Bone densitometry[b]	On starting home parenteral nutrition Then every 2 years	Metabolic bone disease diagnosis	Together with lab tests for metabolic bone disease
a These tests are needed primarily for people having parenteral nutrition in the community. b These tests are rarely needed for people having enteral tube feeding (in hospital or in the community), unless there is cause for concern.			